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ABSTRACT

This task-based curriculum guide for heating, air conditioning, and refrigeration is intended to help the teacher develop a classroom management system where students learn by doing. Introductory materials include a Dictionary of Occupational Titles job code and title sheet, a career ladder, a matrix relating duty/task numbers to job titles, and a task list. Each task is then outlined in this format: statement of duty, statement of task, duty and task numbers, a checklist of achievement indicators, a statement of the criteria for achievement of competence, specification of required tools and equipment and resources, and lists of teacher activities and student learning activities. The tasks are categorized by 14 duties: practicing soldering, bending, swaging, and flaring techniques; cutting, threading, and installing black iron pipe; servicing refrigeration and air conditioning systems; servicing pneumatic systems; servicing electronic systems; fabricating duct systems; designing systems; servicing electrical components; servicing gas burners; servicing oil burners; servicing forced air systems; servicing hydronic systems; servicing general heating systems; and using employability skills. Other contents include student and class achievement records, tool/equipment lists, and a bibliography. (YLB)

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# TRADE & INDUSTRIAL EDUCATION

## INTRODUCTION

The Michigan Department of Education, Vocational-Technical Education Service, has adopted descriptions and codes for vocational-technical education programs found in the document entitled, "A Classification of Instructional Programs" (C.I.P.) National Center for Educational Statistics, February, 1981. This new coding system is required of all States in reporting data on all programs receiving funds under P.L. 94-482, the Vocational Education Amendments of 1976.

The United States Office of Education (U.S.O.E.) coding system was discontinued at the conclusion of the 1981-82 school year. The 1982-83 school year was a transition year from the U.S.O.E. code system to the new C.I.P. Code system.

Michigan Secondary Trade and Industrial Education programs/courses are included in the following Classification of Instructional Program (C.I.P.) Codes.

| CIP | PROGRAM DESCRIPTOR |
|---|---|
| 46.000 | Construction Trades |
| 47.000 | Mechanics and Repairers |
| 48.000 | Precision Production |
| 49.000 | Transportation and Material Moving |

NOTE: The Trade and Industrial Education programs/courses codes not found in the above codes, but included under Michigan Trade and Industrial programs/courses are:

| CIP | PROGRAM DESCRIPTOR |
|---|---|
| 09.0701 | Radio/T.V. General |
| 12.0403 | Cosmetology |
| 43.0107 | Law Enforcement |

This Michigan Trade and Industrial Education Curriculum Guide uses the new C.I.P. program description code(s) and lists the entry level job titles associated with the occupational program area by the Dictionary of Occupational Titles (Fourth Edition, 1977), D.O.T. Code, and the Michigan Occupational Information System, (M.O.I.S.), Numerical Index code. NOTE: This information is located under Job Information with program description(s).

## PROGRAM DEFINITIONS/GOALS

### Vocational Education

The term "vocational education" means organized educational programs which are directly related to the preparation for paid or unpaid employment or for additional preparation for a career requiring other than a baccalaureate or advanced degree.[1]

### Michigan's Major Mission and Goals of Vocational-Technical Education

The delivery system of Vocational-Technical Education in Michigan will be developed around a major mission and four complementary goals.

Mission: Persons of all ages in all Michigan communities will have ready access to high quality vocational and technical education which is realistic in the light of actual or anticipated opportunities for gainful employment and consistent with their needs, interests and abilities.

Goal I: Persons with differing sex, age, racial/ethnic background, socio-economic status, academic disadvantage, economic disadvantage, limited English proficiency, physical and mental capabilities, and geographical location will have access to vocational-technical education and training or retraining and shall not be excluded from such programs because of any distinguishable personal characteristics.

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[1] The Education Amendments of 1976, Section 195(1), Public Law 94-482.

Goal II: All local vocational-technical education programs will be of such quality as to assure that all students are provided learning experiences which are realistic and sufficient in light of their occupational objective.

Goal III: All prevocational/exploration, career guidance and placement programs will be coordinated with local vocational-technical education programs so that each student may make an informed and realistic occupational choice and have access to quality job placement programs.

Goal IV: All local vocational-technical education programs will be planned, monitored, and evaluated in light of actual or anticipated employment opportunities and the demand by students for programs related to their abilities and occupational objectives.

Goal V: Local, public, secondary, and postsecondary educational institutions will be responsive to the economic development and job training/retraining needs of business, industry and labor in their communities.[2]

## Trade and Industrial Education

A vocational education curriculum that includes programs for manufacturing, construction, mechanical service, public service, health service, technical, and fisheries occupations, that prepares a person for entry level employment, upgrading or retraining in a semiskilled or skilled trade, semiprofessional or technical occupation, not generally classified as Agriculture, Distributive, Business or Office, in the Health profession, or Consumer/Home Economics in nature.

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[2] The Annual and Long Range State Plan for Vocational Education in Michigan 1984-87.

NOTE: The occupational clusters found within the scope of trade and industrial education include skilled or semiskilled trade, craft, or occupations which directly relate to the designing, producing, processing, assembling, maintaining, servicing, or repairing of any manufactured product.

## TRADE AND INDUSTRIAL EDUCATION STUDENT ORGANIZATION

### VICA

The Vocational Industrial Clubs of America (VICA) is the national organization serving trade, industrial, technical, and health occupations students in the United States. VICA incorporates leadership, citizenship, and character development programs and activities into the skill training offered in America's schools and taught by men and women who have worked in the occupational areas in which they now instruct their students.

VICA emphasizes respect for the dignity of work, high standards in trade ethics, workmanship, scholarship, and safety. VICA promotes understanding of the free enterprise system and encourages development of patriotism through the practice of democracy within the club.

Competitive activities in the trade skills as well as areas such as public speaking, job interview, parliamentary procedure and safety are vital aspects of VICA's program.

## TRADE AND INDUSTRIAL EDUCATION CURRICULUM GUIDE

This Michigan Trade and Industrial Education Curriculum Guide is the result of a project funded by the Michigan State Board of Education and the Michigan Department of Education. Vocational-Technical Education Service. The project is located at Michigan State University in the Department of

Agricultural and Extension Education (AEE), College of Agriculture and Natural Resources and is known as the Curriculum Resource Team.

The project is directed by Dr. Chris M. Olson and Ms. Carol E. Culpepper, Faculty Specialist, Curriculum Resource Team Coordinators. They were responsible for developing the curriculum format and working with a task force leader and committee of individuals from business, industry, and education to ensure the quality of the curriculum. The development of this curriculum was monitored by Melvin France, Secondary Trade and Industrial Education Supervisor.

The names of the occupational task force leader(s) committee members, secretaries, and other support staff are acknowledged after this Introduction.

The occupational program area(s) selected for curriculum development are based on a Vocational-Technical Education Service prioritized program ranking based on employment demand, State average percent of placement, reimbursed enrollments, the number of programs, and entry level wages within the State of Michigan.

This curriculum guide was developed from the results of a statewide survey and job analysis of incumbent workers in the related occupational areas.

The curriculum guide is representative of the occupational job duty categories which list major activities and tasks performed on an entry level job. The curriculum guide contains a resource list and criteria statements which indicate the minimum standards of performance accepted as evidence of competence in completion of the task by business and industry. This is a task-based curriculum guide which helps a teacher develop a classroom management system where students learn by doing. It is based on task analysis and reflects the skills, knowledge, and attitudes that employers expect incumbent workers to possess.

The curriculum is linked to the labor market, helps the instructor open communication channels with business and industry, and manage classroom instruction where students learn "Need-to-Know" instead of "Nice-to-Know" facts.

This curriculum is adaptable for special needs/handicapped students, helps to validate the program, prepares students for entry level jobs and helps students to make career choices related to job placement.

It is the intent by all those involved in the development of this curriculum guide that it be used to provide relevant training or retraining for employment in the world of work.

The secondary occupational programs/courses in Michigan should meet the following minimum standards to assure soundness and quality of instruction:

1. The program of instruction must be based on a consideration of the skills and knowledge required in the occupation for which the instruction is being provided, and includes a planned logical sequence for those essentials of education or experience deemed necessary for the individual to meet an occupational objective.

2. The program of instruction must be developed and conducted in consultation with a Local Advisory Council/Committee which has an appropriate representation of both sexes and an appropriate representation of racial and ethnic minorities found in the program area, school, and community origin. The local advisory council will advise on current job needs, relevance of programs, and courses in meeting current job needs and consult with the local educational agency in developing program application.

3. The program of instruction will include the most up-to-date curriculum based on the competencies required in the occupation or occupational field in which the individual is being prepared, upgraded, or updated.

4. The program of instruction will be sufficiently extensive in duration and intensive within a schedule unit of time to enable the student to develop the necessary knowledge, attitudes, and skills necessary for employment in the occupation or occupational field.

5. The program of instruction will combine and coordinate related instruction with field, shop, laboratory, cooperative work, or other occupational experience which is appropriate to the vocational objective of the student, is of sufficient duration to develop competencies necessary for employment in the occupation or occupational field, and supervised, directed, or coordinated by a person qualified under the State Plan.

Facilities, equipment, and instructional materials:

1. Classrooms, libraries, shops, laboratories, and other facilities, including instructional equipment, supplies, teaching aids, and other materials will be adequate in supply and quality to meet the standards approved by the State Board so that such facilities are adequate to enable those who are to be trained to meet the occupational objective for which the education is intended.

2. If the State Board or local educational agency cannot provide adequate facilities and materials, and such are available in a business or industrial establishment, funds may be used to reimburse the local public educational agency for training programs conducted in private industry when it complies with the training standards and regulations established by the State Board. Such instruction shall be under the supervision and administration of a local public educational agency.

## ACKNOWLEDGEMENT

The Michigan Trade and Industrial Curriculum Guide(s) were developed through a series of workshops held throughout the State and at Michigan State University during the 1983-84 school year.

Appreciation is given to all who have contributed their thoughts, time and energy to this curriculum project.

The Michigan Department of Education, Vocational-Technical Education Service, is indebted to the following individuals who were instrumental in the completion of this project and the development of the materials:

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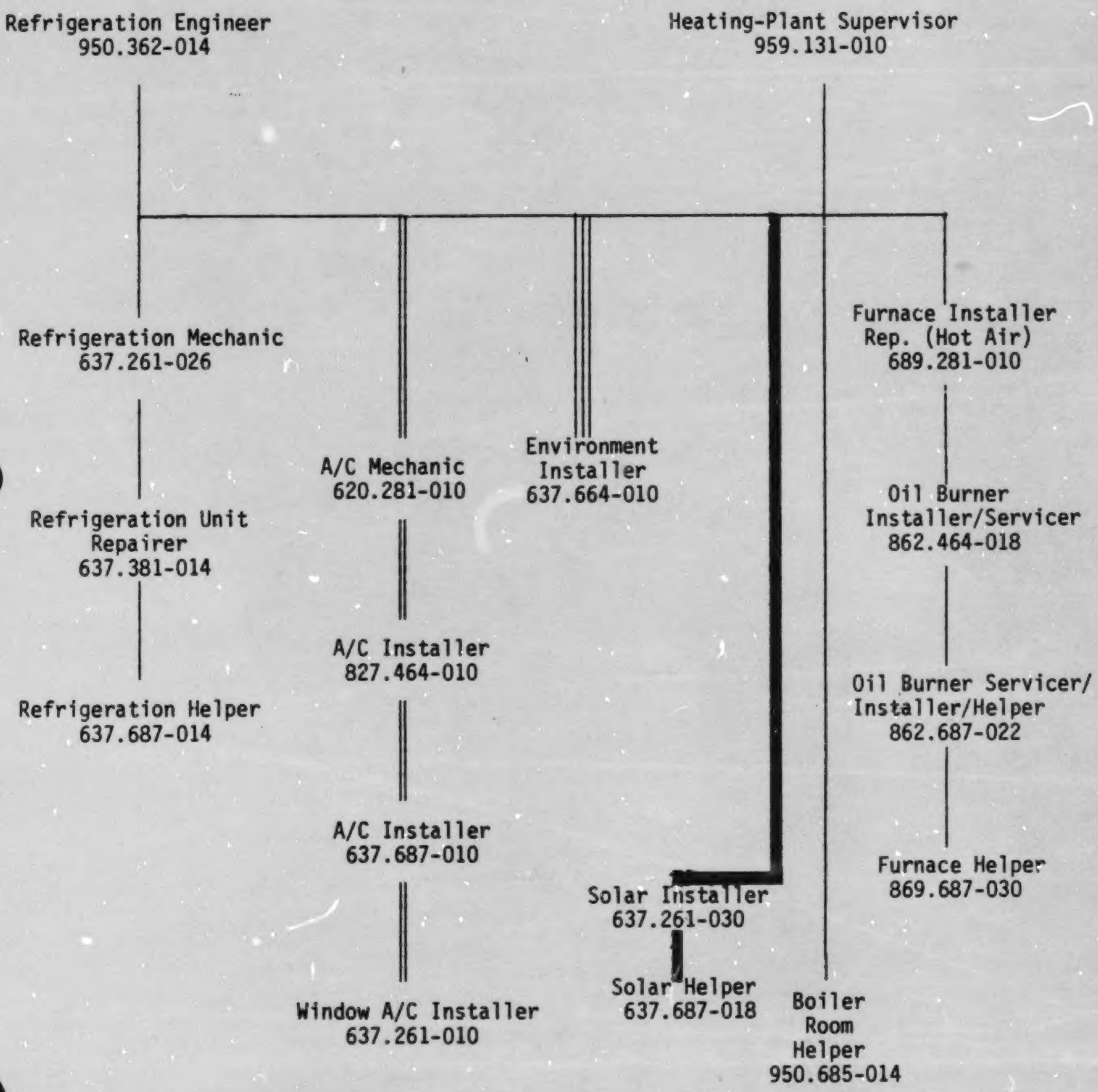
Special recognition is also given to Michigan's employers and employees who participated in a Task Analysis Survey. They assisted with validating the curriculum by identifying job titles, tasks performed on the job and tools and equipment.

# CLIMATE CONTROL
# (HVAC)
# CAREER LADDER



Refrigeration Engineer
950.362-014

Heating-Plant Supervisor
959.131-010

Refrigeration Mechanic
637.261-026

Refrigeration Unit Repairer
637.381-014

Refrigeration Helper
637.687-014

A/C Mechanic
620.281-010

A/C Installer
827.464-010

A/C Installer
637.687-010

Window A/C Installer
637.261-010

Environment Installer
637.664-010

Solar Installer
637.261-030

Solar Helper
637.687-018

Boiler Room Helper
950.685-014

Furnace Installer Rep. (Hot Air)
689.281-010

Oil Burner Installer/Servicer
862.464-018

Oil Burner Servicer/Installer/Helper
862.687-022

Furnace Helper
869.687-030

## D.O.T. JOB CODE AND TITLE SHEET

## HEATING, AIR CONDITIONING, AND REFRIGERATION

| D.O.T. NUMBER | JOB TITLE |
|---|---|
| 637.687-014 | Refrigeration Helper |
| 862.687-022 | Oil Burner Servicer and Installer Helper |
| 869.687-030 | Furnace Installer Helper - Hot Air |
| 637.687-010 | Air Conditioning Installer Helper |
| 950.685-014 | Boiler Room Helper |
| 637.381-014 | Refrigeration Unit Repairer |
| 637.261-026 | Refrigeration Mechanic |
| 620.281-010 | Air Conditioning Mechanic |
| 637.664-010 | Environmental Control System Installation Servicer |
| 862.464-018 | Oil Burner Installer and Servicer |
| 689.281-010 | Furnace Installer and Repairer - Hot Air |
| 827.464-010 | Air Conditioning Installer |
| 637.261-010 | Air Conditioning Installer/Servicer - Window Unit |
| 950.362-014 | Refrigeration Engineer |
| 168.167-046 | Inspector - Heating and Refrigeration |
| 959.131-010 | Heating - Plant Supervisor |

## DUTY/TASK - JOB MATRIX

| JOB TITLES / DUTY/TASK NUMBERS | Refrigeration Helper | Boiler Room Helper | Solar Helper | Oil Burner Servicer | Solar Installer | Furnace Helper | A/C Helper | Refrigeration Repairer | Refrigeration Mechanic | A/C Mechanic | Environment Installer | Oil Burner Installer | Furnace Repairer | A/C Installer | A/C (window) Servicer | Refrigeration Engineer | Inspector | Heating Supervisor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A - 1 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 2 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 3 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 4 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 5 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 6 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 7 | X | | | | | | X | X | X | X | | | | X | X | X | X | |
| 8 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| | | | | | | | | | | | | | | | | | | |
| B - 1 | | X | | X | | X | | | | | | X | X | | | | X | X |
| 2 | | X | | X | | X | | | | | | X | X | | | | X | X |
| 3 | | X | | X | | X | | | | | | X | X | | | | X | X |
| 4 | | X | | X | | X | | | | | | X | X | | | | X | X |
| | | | | | | | | | | | | | | | | | | |
| C - 1 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 2 | X | | | | | | | X | X | | | | | | | X | | |
| 3 | | | | | | | X | X | X | | | | | | X | X | | |
| 4 | | | | | | | X | X | X | | | | | | X | X | | |
| 5 | | | | | | | X | X | X | | | | | | X | X | | |

## DUTY/T[illegible] - JOB MATRIX

DUTY/TASK NUMBERS

| JOB TITLES | Refrigeration Helper | Boiler Room Helper | Solar Helper | Oil Burner Servicer | Solar Installer | Furnace Helper | A/C Helper | Refrigeration Repairer | Refrigeration Mechanic | A/C Mechanic | Environment Installer | Oil Burner Installer | Furnace Repairer | A/C Installer | A/C (window) Servicer | Refrigeration Engineer | Inspector | Heating Supervisor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C - 6 | | | | | | | | X | X | X | | | | | X | X | | |
| 7 | | | | | | | | X | X | X | | | | | X | X | | |
| 8 | | | | | | | | X | X | X | | | | | X | X | | |
| 9 | | | | | | | | X | X | X | | | | | X | X | | |
| 10 | | | | | | | | X | X | X | | | | | X | X | | |
| 11 | | | | | | | | X | X | X | | | | | X | X | | |
| 12 | | | | | | | | X | X | X | | | | | X | X | | |
| 13 | | | | | | | | X | X | X | | | | | X | X | | |
| 14 | | | | | | | | X | X | X | | | | | X | X | | |
| 15 | | | | | | | | X | X | X | | | | | X | X | | |
| 16 | | | | X | X | X | X | X | X | X | | X | X | X | X | X | | X |
| 17 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 18 | | | | | | | | X | X | X | | | | | X | X | | |
| 19 | | | | | | | | X | X | X | | | | | X | X | | |
| 20 | | | | | | | | X | X | X | | | | | X | X | | |
| 21 | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 22 | | | | | X | X | X | X | X | X | X | | X | X | X | X | X | X |
| 23 | | | | | | | X | X | | X | | | | X | X | | | |
| 24 | | | | | | | X | X | X | X | | | | | X | | | |

## DUTY/TASK - JOB MATRIX

| JOB TITLES<br>DUTY/TASK NUMBERS | Refrigeration Helper | Boiler Room Helper | Solar Helper | Oil Burner Servicer | Solar Installer | Furnace Helper | A/C Helper | Refrigeration Repairer | Refrigeration Mechanic | A/C Mechanic | Environment Installer | Oil Burner Installer | Furnace Repairer | A/C Installer | A/C (window) Servicer | Refrigeration Engineer | Inspector | Heating Supervisor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C - 25 | | | | | | | X | X | X | X | | | | | X | | | |
| 26 | X | | | | | | X | X | X | X | | | | | X | X | | X |
| 27 | | | | | | | | | X | X | | | | | | X | | |
| 28 | | | | | | | | | X | X | | | | | | X | | |
| | | | | | | | | | | | | | | | | | | |
| D - 1 | | X | | | | | | | X | X | X | | X | | | X | | X |
| 2 | | X | | | | | | | X | X | X | | X | | | X | | X |
| 3 | | X | | | | | | | X | X | X | | X | | | X | | X |
| 4 | | X | | | | | | | X | X | X | | | | | X | | X |
| 5 | | X | | | | | | | X | X | X | | | | | X | | X |
| | | | | | | | | | | | | | | | | | | |
| E - 1 | | | | X | X | | | X | X | X | X | X | X | X | | X | | X |
| 2 | | | | | X | | | X | X | X | X | | X | X | | X | | X |
| 3 | | | | X | X | | | X | X | X | X | X | X | | | | | |
| 4 | | | | X | X | | | X | X | X | X | X | X | | | X | | X |
| 5 | | | | X | X | | | X | X | X | X | X | X | | | X | | X |
| | | | | | | | | | | | | | | | | | | |
| F - 1 | | | | | X | X | X | | | | | | | X | | | | X |
| 2 | | | | | X | X | X | | | | | | | X | | | | X |

## DUTY/TAS[illegible] JOB MATRIX

| JOB TITLES<br>DUTY/TASK NUMBERS | Refrigeration Helper | Boiler Room Helper | Solar Helper | Oil Burner Servicer | Solar Installer | Furnace Helper | A/C Helper | Refrigeration Repairer | Refrigeration Mechanic | A/C Mechanic | Environment Installer | Oil Burner Installer | Furnace Repairer | A/C Installer | A/C (window) Servicer | Refrigeration Engineer | Inspector | Heating Supervisor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F - 3 | | | | | X | X | X | | | | | | | X | | | | X |
| 4 | | | | | X | X | X | | | | | | | X | | | | X |
| 5 | | | | | | | | X | X | X | X | | X | | | X | | X |
| 6 | | | | | X | X | X | | | | | | | X | | | | X |
| | | | | | | | | | | | | | | | | | | |
| G - 1 | | | | | X | X | X | | | | X | | | X | | X | X | X |
| 2 | | | | | | | | | | | | | | | | | | X |
| 3 | | | | | | | | | | | | | | | | | | X |
| 4 | | | | | | | | | | | | | | | | | | X |
| 5 | | | | | | | | | | | | | | | | | | X |
| 6 | | | | | | | | | | | | | | | | | | X |
| 7 | | | | | | | | | | | | | | | | | | X |
| 8 | | | | | | | | | | | | | | | | | | X |
| | | | | | | | | | | | | | | | | | | |
| H - 1 | | X | | X | X | X | X | X | X | X | X | X | X | X | X | X | | X |
| 2 | | X | | X | X | X | X | X | X | X | X | X | X | X | X | X | | X |
| 3 | | X | | X | X | X | X | X | X | X | X | X | X | X | X | X | | X |
| 4 | | X | | X | X | X | X | X | X | X | X | X | X | X | X | X | | X |
| 5 | | X | | X | X | X | X | X | X | X | X | X | X | X | X | X | | X |

## DUTY/TASK - JOB MATRIX

| DUTY/TASK NUMBERS / JOB TITLES | Refrigeration Helper | Boiler Room Helper | Solar Helper | Oil Burner Servicer | Solar Installer | Furnace Helper | A/C Helper | Refrigeration Repairer | Refrigeration Mechanic | A/C Mechanic | Environment Installer | Oil Burner Installer | Furnace Repairer | A/C Installer | A/C (window) Servicer | Refrigeration Engineer | Inspector | Heating Supervisor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H - 6 | | X | | X | X | X | X | X | X | X | X | X | X | X | X | X | | X |
| 7 | | X | | X | X | X | X | X | X | X | X | X | X | X | X | X | | X |
| 8 | | X | | X | X | X | X | X | X | X | X | X | X | X | X | X | | X |
| | | | | | | | | | | | | | | | | | | |
| I - 1 | | X | | | | X | | | | | | | X | | | | | X |
| 2 | | X | | | | X | | | | | | | X | | | | | X |
| 3 | | X | | | | X | | | | | | | X | | | | | X |
| 4 | | X | | | | X | | | | | | | X | | | | | X |
| 5 | | X | | | | X | | | | | | | X | | | | | X |
| | | | | | | | | | | | | | | | | | | |
| J - 1 | | X | | X | | X | | | | | | X | X | | | | | X |
| 2 | | X | | X | | X | | | | | | X | X | | | | | X |
| 3 | | | | X | | X | | | | | | X | X | | | | | X |
| | | | | | | | | | | | | | | | | | | |
| K - 1 | | | | X | | X | | | | | X | X | X | | | | | X |
| 2 | | | | X | | X | | | | | | X | X | | | | | X |
| 3 | | | | X | | X | | | | | | X | X | | | | | X |
| 4 | | | | X | | X | X | | | X | X | X | X | X | | | | X |
| | | | | | | | | | | | | | | | | | | |

## DUTY/TASK - JOB MATRIX

| DUTY/TASK NUMBERS / JOB TITLES | Refrigeration Helper | Boiler Room Helper | Solar Helper | Oil Burner Servicer | Solar Installer | Furnace Helper | A/C Helper | Refrigeration Repairer | Refrigeration Mechanic | A/C Mechanic | Environment Installer | Oil Burner Installer | Furnace Repairer | A/C Installer | A/C (window) Servicer | Refrigeration Engineer | Inspector | Heating Supervisor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L - 1 | | X | | X | X | X | | | | X | | X | | | | | | X |
| 2 | | X | | X | X | | | | | | X | | | | | | | X |
| 3 | | X | | X | X | | | | | | | | | | | | | X |
| 4 | | X | | X | X | | | | | | | | | | | | | X |
| 5 | | X | | X | X | | | | | | | | | | | | | X |
| 6 | | X | | X | X | | | | | | | | | | | | | X |
| 7 | | X | | X | X | | | | | | X | | | | | | | X |
| | | | | | | | | | | | | | | | | | | |
| M - 1 | | X | | X | | | | | | | | X | X | | | | | X |
| 2 | | X | | X | | X | | | | | | X | X | | | | | X |
| 3 | | X | | X | | X | | | | | | X | X | | | | | X |
| 4 | | X | | X | | X | | | | | | X | X | | | | | X |
| 5 | | X | | X | | X | | | | | | X | X | | | | | X |
| 6 | | X | | X | | X | | | | | | X | X | | | | | X |
| 7 | | X | | X | | X | | | | | | X | X | | | | | X |
| | | | | | | | | | | | | | | | | | | |
| N - 1 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 2 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 3 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

# DUTY/TASK - JOB MATRIX

| DUTY/TASK NUMBERS \ JOB TITLES | Refrigeration Helper | Boiler Room Helper | Solar Helper | Oil Burner Servicer | Solar Installer | Furnace Helper | A/C Helper | Refrigeration Repairer | Refrigeration Mechanic | A/C Mechanic | Environment Installer | Oil Burner Installer | Furnace Repairer | A/C Installer | A/C (window) Servicer | Refrigeration Engineer | Inspector | Heating Supervisor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N - 4 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 5 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 6 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 7 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 8 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 9 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 10 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 11 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 12 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 13 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 14 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 15 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 16 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 17 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 18 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 19 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 20 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 21 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

# TASK LIST
# FOR
# HEATING, AIR CONDITIONING AND REFRIGERATION

## A. PRACTICING SOLDERING, BENDING, SWAGING AND FLARING TECHNIQUES

1. Cut copper tubing, using tube cutters and job sheet, to use in the assembly of a refrigeration or water line.
2. Swage copper tubing, using swaging tool and other necessary tools and equipment, to use in the assembly of a refrigeration or water line.
3. Flare copper tubing, using swaging tool and other necessary tools and equipment, to connect tubing to a flare fitting.
4. Bend copper tubing, using all necessary tools, to assemble a refrigeration system.
5. Solder copper tubing, using 50/30 solder and all necessary tools, to install a water supply or drain line.
6. Solder copper tubing, using 95/5 solder and all necessary tools and equipment, to install or repair a refrigeration line.
7. Silver solder copper tubing, using 15% sil-phos, to install or repair a refrigeration line.
8. Solder electrical connections,using all necessary tools and meterials, to connect electrical wire circuits.

## B. CUTTING, THREADING AND INSTALLING BLACK IRON PIPE

1. Cut pipe, using pipe cutters, to prepare it for threading.
2. Thread pipe, using a hand operated threader and all of the necessary tools, to connect it to a gas line.
3. Thread pipe, using an electric pipe threader, to connect it to a gas line.
4. Install gas piping, using all necessary tools and equipment, to provide fuel for combustion in a furnace.

## C. SERVICING REFRIGERATION AND AIR CONDITIONING SYSTEMS

1. Level a unit, using knowledge and proper tools, to provide proper installation.
2. Check door seal, using knowledge and proper tools, to ensure a good seal of compartments.
3. Install a refrigerant system component, using all necessary tools and equipment, to insure protection of compressor motor from moisture and non-condensables.

C. SERVICING REFRIGERATION AND AIR CONDITIONING SYSTEMS (continued)

4. Install core-type service valves, using proper tools, to evacuate and charge a refrigeration system.

5. Evacuate a refrigeration or air conditioning system, using all necessary tools and equipment, to ensure that the system is free of air and moisture.

6. Test for leaks on a refrigerator or air conditioning system, using leak detectors, to insure that the system is sealed.

7. Static charge a refrigeration or air conditioning system, using all necessary tools and equipment, to provide sufficient refrigeration.

8. Take temperature and pressure readings, using proper tools and equipment, to determine system efficiency.

9. Adjust a thermostatic expansion valve, using knowledge and proper tools, to insure proper superheat.

10. Charge an operating system, using refrigerant vapor and all necessary tools, to provide proper cooling.

11. Add oil to a system, using knowledge and proper tools, to insure that proper oil level is maintained in the compressor.

12. Test a hermetic compressor motor, using an ohmmeter and necessary tools, to determine condition of motor windings and valves.

13. Adjust an automatic expansion valve, using knowledge and proper tools, to insure proper superheat.

14. Troubleshoot a refrigeration system, using knowledge and proper tools, to determine system malfunction and remedy.

15. Service a water regulating valve, using knowledge and the proper tools, to provide proper cooling of refrigerant in a water-cooled condenser.

16. Replace belts, using all tools necessary, to provide proper belt tension, alignment of pulleys and motor amperage.

17. Replace air filter, using knowledge and tools necessary, to provide clean, filtered air that is returning to the air conditioning system.

18. Perform annual maintenance on an air conditioning system, uisng all the necessary tools, to insure that the system is clean and running at peak efficiency.

19. Check performance of an air conditioning system, using knowledge and all necessary tools and equipment, to determine system energy efficiency ratio (EER).

## C. SERVICING REFRIGERATION AND AIR CONDITIONING SYSTEMS (continued)

20. Wire a refrigeration system, using knowledge, wiring diagrams and necessary tools, to provide comfort cooling.

21. Install heat-cool thermostat and sub-base, using all necessary tools, to provide temperature control of a conditioned space.

22. Apply psychrometric charts, using the necessary test instruments and knowledge, to determine air sample conditions and system performance information.

23. Install an air conditioning system, using proper tools, equipment and recommended installation practice, to manufacturer and industry specifications.

24. Treat cooling water, using chemicals and cleaning equipment, to insure proper water quality.

25. Service cooling towers, using necessary tools and equipment, to insure proper water cooling operations.

26. Service heat exchangers, using necessary tools, to insure proper heat exchange.

27. Service absorption systems, using appropriate tools and knowledge, to insure proper operation.

28. Service centrifugal system, using necessary tools and test equipment, to insure proper operation.

## D. SERVICING PNEUMATIC SYSTEMS

1. Check operating pressures, using correct test instruments, to insure proper operating pressures.

2. Service pneumatic controls, using proper tools, to insure proper operation and calibration.

3. Service pneumatic controlled devices, using appropriate tools, to insure proper operation and adjustment.

4. Service air driers, using correct tools and service procedures, to manufacturer's specifications.

5. Service air compressors, using necessary tools and service manuals, to insure proper operation.

## E. SERVICING ELECTRONIC SYSTEMS

1. Service electronic control, using appropriate tools and test meters, to insure proper operation.

E. SERVICING ELECTRONIC SYSTEMS (continued)

2. Service energy management control systems, using necessary tools, and test meters, to insure proper operation.

3. Service electronic timing devices, using appropriate tools and test meters, to determine proper operation.

4. Service solid state control boards, using necessary test instruments, to insure proper input and output levels.

5. Service electronic sensing devices, using proper test instruments, to determine correct output levels.

F. FABRICATING DUCT SYSTEMS

1. Fabricate sheet metal fittings, using necessary tools and equipment, to form the fitting to correct specifications.

2. Fabricate duct board fittings, using appropraite duct board tools, to form the fitting to correct tolerances.

3. Install ducting, using appropriate tools, to conform to installation practices.

4. Install diffusers and grill, using necessary tools, to conform to industry standards.

5. Measure air properties, using appropriate test instruments, to determine the conditions that exist.

6. Draft fittings, using drafting equipment and methods, to construct a pattern or plan for fittings.

G. DESIGNING SYSTEMS

1. Read blueprints, using appropriate prints and knowledge, to locate specific building components.

2. Calculate heat gain/loss, using appropriate blueprints and data, to determine the amount of heat movement.

3. Calculate duct size, using appropriate design booklets and knowledge, to layout ducting and size runs.

4. Calculate pipe size, using appropriate tables and graphs, to determine correct size.

5. Calculate product load, using product data sheets and knowledge of latent and sensible heat, to determine heat load within an enclosure.

6. Select equipment, using heat load and design data, to identify components necessary to deliver designed system performance.

G. DESIGNING SYSTEMS (continued)

7. Prepare bid proposal, using selected equipment and information on costs (overhead and job related), to determine retail cost of equipment installation.

8. Calculate solar insolance, using appropriate climatic data, to obtain amounts of heat per square foot on a surface.

H. SERVICING ELECTRICAL COMPONENTS

1. Demonstrate the use of test meters, using selected test instruments, to determine values of electricity.

2. Service capacitors, using appropriate test meters, to determine the condition of the capacitors.

3. Service relays/contractors, using necessary test instruments, to insure proper operation.

4. Service motors, using knowledge and all necessary tools, to determine condition of motor windings.

5. Service controls, using knowledge and necessary tools, to determine operating condition.

6. Service heaters, using volt-ohmmeter and necessary tools, to determine operating condition.

7. Service transformers, using volt-ohmmeter and all necessary tools, to deremine voltage output.

8. Trouble shoot, using appropriate test instruments and hand tools, to ascertain the source of the problem.

I. SERVICING GAS BURNERS

1. Test gas valve operation, using proper test instruments, to insure proper operation.

2. Check ignition circuit, using correct test instruments, to insure for proper ignition.

3. Derate or change over a gas burner, using correct orfice size, to insure the proper input is obtained.

4. Check and adjust gas gun, using correct tools and procedures, to insure proper operation.

5. Check and adjust atmospheric injection burners, using correct test instruments, to insure proper operation.

J. SERVICING OIL BURNERS

1. Service primary controls, using necessary tools and test equipment, to check for proper operation and safety limit.

2. Check and adjust high/low pressure gun, using correct test instruments and procedures, to insure proper operation.

3. Check and adjust vaporizing burners, using correct tools and procedures, to insure proper operation.

K. SERVICING FORCED AIR SYSTEMS

1. Service fan and limit control, using appropriate test instruments, to check for proper operation and safety limit.

2. Install a humidifier, using the proper tools, disgram, and recommended installation practices, to manufacturer's specifications.

3. Check blower components, using correct tools, to insure proper operating characteristics.

4. Check operation of fan center, using correct test instruments, to insure proper operation.

L. SERVICING HYDRONIC SYSTEMS

1. Check circulator, using proper procedures and tools, to insure proper operation.

2. Service hydronic aquastat control, using test meters and appropriate tools, to check for proper operation and adjustment.

3. Check operation of pressure/temperature gauge, using proper procedures, to insure for correct operation.

4. Check and adjust the pressure reducing valve, using the correct tools, to insure proper operation.

5. Check operation of expansion tank, using correct test instruments, to insure proper operation.

6. Check zone valve, using proper procedures and test instruments, to insure correct operation.

7. Check safety controls, using correct procedure and gauges, to insure proper operation.

M. SERVICING GENERAL HEATING SYSTEMS

1. Perform a combustion test, using a combustion test kit, to determine burner efficiency.

M. SERVICING GENERAL HEATING SYSTEMS (continued)

2. Wire a heating system, using appropriate schematic, tools, and knowledge to manufacturer's specifications.

3. Clean and check a heating system, using appropriate tools, to insure proper operation.

4. Check vent damper, using correct instrumentation, to insure proper operation.

5. Vent sizing, using the proper charts and manufacturer's specifications, to insure correct vent capacity.

6. Install heating systems, using correct procedures, to insure a safe installation.

7. Check auxillary or main heaters, using correct test instruments, to insure proper operation.

N. USING EMPLOYABILITY SKILLS

1. Perform a self-assessment, using knowledge and information, to compile a list of personal attributes.

2. Perform a self-assessment, using knowledge and information, to identify areas of work that will provide personal job satisfaction.

3. Perform a self-assessment, using knowledge and information, to determine methods to reduce levels of stress.

4. Compile an occupational profile, using reference materials, to determine the characterists, requiremetns, and employment outlook of an occupation.

5. Investigate non-wage job characteristics, using available resources, to identify significant job factors.

6. Develop goals, using knowledge, to determine career objective(s).

7. Perform a job search, using information, to identify employment oportunities.

8. Participate in an information interview, using knowledge and resources, to obtain information about a job from an employer.

9. Complete a social security form, using information, to apply for a social security number.

10. Contact an employer, using a telephone, to pursue potential employment opportunities.

11. Complete a job application, using personal notes, to apply for employment.

N. USING EMPLOYABILITY SKILLS (continued)

12. Prepare a resume, using personal information, to apply for a job.
13. Write a letter, using personal notes, to apply for a position.
14. Demonstrate appropriate dress, using a knowledge of job requirements, to comply with standards of on-the-job attire and grooming.
15. Interview for a job, using communication skills, to secure employment.
16. Contact a job interviewer, using a telephone, to accept/reject a job.
17. Complete forms, using information, to withhold city, state, and federal taxes.
18. Describe performance evaluation measurements, using knowledge, to identify behavior/attitudes that employers expect employees to exhibit on-the-job.
19. Perform a continuing education program search, using available resources, to identify opportunities for retraining, skills upgrading, and career advancement.
20. Analyze career information, using available resources, to identify the opportunities for advancement that exist within an occupation.
21. Describe job resignation/dismissal practice, using knowledge, to identify positive methods for terminating an employment situation.

**Duty:** Practicing Soldering, Bending, Swaging and Flaring Techniques

**Duty No.** A

**Task No.** 1

**Task:** Cut copper tubing, using tube cutters and job sheet, to use in the assembly of a refrigeration or water line.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and supplies - | _____ | _____ |
| 2. Demonstrated proper use of tools - | _____ | _____ |
| 3. Demonstrated proper handling of copper tubing - | _____ | _____ |
| 4. Successfully cut copper tubing - | _____ | _____ |
| 5. Demonstrated acceptable safety habits - | _____ | _____ |
| 6. Cleaned work area and tools - | _____ | _____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

| Teacher Activities | Student Learning Activities |
|---|---|
| 1. Review with student the pre-test on "Tubing." | 1. Read module and do pre-test. |
| 2. Show student different types and sizes of tubing. | 2. View slides on "Tubing." |
| 3. Show slides on cutting copper tubing. | 3. Cut copper tubing using tube cutters. |
| 4. Demonstrate the use of tube cutters. | 4. Take post-test. |
| 5. Have student cut tubing as specified on job sheet and evaluate. | |
| 6. Summarize main points of how to cut tubing. | |
| 7. Give post-test. | |

**Duty:** Practing Soldering, Bending, Swaging and Flaring Techniques

**Duty No.** A

**Task No.** 2

**Task:** Swage copper tubing, using swaging tool and other necessary tools and equipment, to use in the assembly of a refrigeration or water line.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper swaging tools and supplies - | _____ | _____ |
| 2. Demonstrated proper use of all tools - | _____ | _____ |
| 3. Swaged copper tubing correctly - | _____ | _____ |
| 4. Demonstrated acceptable safety habits - | _____ | _____ |
| 5. Cleaned work area and tools - | _____ | _____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Practicing Soldering, Bending, Swaging and Flaring Techniques

**Duty No.** A

**Task No.** 3

**Task:** Flare copper tubing, using swaging tool and other necessary tools and equipment, to connect tubing to a flare fitting.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected correct flaring tools and supplies to complete job sheet - | ____ | ____ |
| 2. Demonstrated proper use of flaring tools - | ____ | ____ |
| 3. Placed flare nut on tubing before flaring - | ____ | ____ |
| 4. Flared copper tube properly - | ____ | ____ |
| 5. Demonstrated acceptable safety habits - | ____ | ____ |
| 6. Cleaned work area and tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Practicing Soldering, Bending, Swaging and Flaring Techniques

**Duty No.** A

**Task No.** 4

**Task:** Bend copper tubing, using all necessary tools, to assemble a refrigeration system.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and supplies needed to complete job sheet - | ____ | ____ |
| 2. Demonstrated proper use of bending tools - | ____ | ____ |
| 3. Completed job sheet according to measurements and correct bends - | ____ | ____ |
| 4. Demonstrated acceptable safety habits - | ____ | ____ |
| 5. Cleaned work area and tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

| | |
|---|---|
| **Duty:** Practicing Soldering, Bending, Swaging and Flaring Techniques | **Duty No.** A<br>**Task No.** 5 |

**Task:** Solder copper tubing, using 50/50 solder and all necessary tools, to install a water supply or drain line.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and supplies as directed by job sheet - | ____ | ____ |
| 2. Demonstrated proper use of soldering tools (i.e., torch, solder, flux, sandpaper, hand tools) - | ____ | ____ |
| 3. Cleaned and prepared solder joint for soldering properly - | ____ | ____ |
| 4. Demonstrated correct soldering techniques - | ____ | ____ |
| 5. Demonstrated acceptable safety habits - | ____ | ____ |
| 6. Cleaned work area, tools and supplies - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

| | |
|---|---|
| **Tools and Equipment:** | **Resources:** |

**Duty:** Practicing Soldering, Bending, Swaging and Flaring Techniques

**Duty No.** A

**Task No.** 6

**Task:** Solder copper tubing, using 95/5 solder and all necessary tools and equipment, to install or repair a refrigeration line.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | ____ | ____ |
| 2. Demonstrated acceptable soldering procedures - | ____ | ____ |
| 3. Demonstrated proper use of all soldering tools and material (torch, flux, solder) - | ____ | ____ |
| 4. Soldered with 95/5 solder successfully - | ____ | ____ |
| 5. Demonstrated acceptable safety habits - | ____ | ____ |
| 6. Cleaned work area and tools - | ____ | ____ |

**Criteria:** Competence in the task will be recogonized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Practicing Soldering, Bending, Swaging and Flaring Techniques

**Duty No.** A

**Task No.** 7

**Task:** Silver solder copper tubing, using 15% sil-phos, to install or repair a refrigeration line.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | ____ | ____ |
| 2. Demonstrated acceptable soldering procedures - | ____ | ____ |
| 3. Demonstrated proper use of all soldering tools and material (torch, flux, solder) - | ____ | ____ |
| 4. Soldered using 15% sil-phos successfully - | ____ | ____ |
| 5. Demonstrated acceptable safety habits - | ____ | ____ |
| 6. Cleaned work area and tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Practicing Soldering, Bending, Swaging and Flaring Techniques

**Duty No.** A

**Task No.** 8

**Task:** Solder electrical connections, using all necessary tools and materials, to connect electrical wire circuits.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | ____ | ____ |
| 2. Demonstrated acceptable electric soldering procedures - | ____ | ____ |
| 3. Demonstrated proper use of all soldering tools and material (torch, flux, solder) - | ____ | ____ |
| 4. Soldered electrical connections successfully - | ____ | ____ |
| 5. Demonstrated acceptable safety habits - | ____ | ____ |
| 6. Cleaned work area and tools - | ____ | ____ |

**Criteria:**

**Tools and Equipment:**

**Resources:**

**Duty:** Cutting, Threading and Installing Black Iron Pipe

**Duty No.** B

**Task No.** 1

**Task:** Cut pipe, using pipe cutters, to prepare it for threading.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Selected the proper tools - | _____ | _____ |
| 2. Demonstrated acceptable pipe cutting procedures - | _____ | _____ |
| 3. Cut black iron pipe successfully - | _____ | _____ |
| 4. Demonstrated acceptable safety habits - | _____ | _____ |
| 5. Cleaned work area and tools - | _____ | _____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

| Teacher Activities | Student Learning Activities |
|---|---|
| 1. Review slides on use of the pipe cutters. | 1. Read reference material on pipe and pipe cutting and threading tools. |
| 2. Present lecture on pipe and pipe sizing. | 2. View slides on pipe cutting and threading. |
| 3. Demonstrate use of pipe cutters. | 3. Demonstrate how to cut pipe correctly. |
| 4. Have student demonstrate how to cut pipe with pipe cutters. | 4. Take post-test for this task. |
| 5. Evaluate the student demonstration of the task. | |
| 6. Give post-test. | |

**Duty:** Cutting, Threading and Installing Black Iron Pipe

**Duty No.** B

**Task No.** 2

**Task:** Thread pipe, using a hand operated threader and all of the necessary tools, to connect it to a gas line.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Selected the proper tools and supplies - | ____ | ____ |
| 2. Demonstrated proper use of threading tools - | ____ | ____ |
| 3. Used correct procedures for threading pipe - | ____ | ____ |
| 4. Hand threaded iron pipe successfully - | ____ | ____ |
| 5. Demonstrated acceptable safety habits - | ____ | ____ |
| 6. Cleaned work area and tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Cutting, Threading, and Installing Black Iron Pipe

**Duty No.** B

**Task No.** 3

**Task:** Thread pipe, using an electric pipe threader, to connect it to a gas line.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools and supplies - | ____ | ____ |
| 2. Demonstrated proper use of the electric threading machine - | ____ | ____ |
| 3. Threaded pipe on the electric pipe threader successfully - | ____ | ____ |
| 4. Demonstrated acceptable safety habits - | ____ | ____ |
| 5. Cleaned work area and tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Cutting, Threading and Installing Black Iron Pipe

**Duty No.** B

**Task No.** 4

**Task:** Install gas piping, using all necessary tools and equipment, to provide fuel for combustion in a furnace.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | ____ | ____ |
| 2. Provided the instructor with a sketch of the gas pipe line to the furnace - | ____ | ____ |
| 3. Provided the instructor with a list of all needed fittings and pipe for the installation of the gas pipe line - | ____ | ____ |
| 4. Demonstrated proper use of threading tools and wrenches - | ____ | ____ |
| 5. Demonstrated acceptable pipe fitting techniques - | ____ | ____ |
| 6. Installed gas piping to a furnace successfully - | ____ | ____ |
| 7. Purged gas line of air and fired furnace - | ____ | ____ |
| 8. Demonstrated acceptable safety habits - | ____ | ____ |
| 9. Cleaned work area and tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 1

**Task:** Level a unit, using knowledge and proper tools, to provide proper installation.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools to perform the task - | ____ | ____ |
| 2. Adjusted leveing legs so that the refrigerator was level - | ____ | ____ |
| 3. Checked door for proper closing - | ____ | ____ |
| 4. Demonstrated proper safety habits - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

| Teacher Activities | Student Learning Activities |
|---|---|
| 1. Review module, pre-test and slides on "Domestic Refrigeration Fundamentals." | 1. Read module and reference materials on "Domestic Refrigerator Fundamentals." |
| 2. Present lecture on the installation procedures and the importance of leveling a refrigerator. | 2. Do pre-test and review with instructor. |
| 3. Demonstrate how to level a refrigerator. | 3. Watch slides on "Transporting and Installing a Refrigerator." |
| 4. Evaluate student demonstration of how to level a refrigerator. | 4. Demonstrate how to level a refrigerator. |
| 5. Summarize main points of task. | |

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 2

**Task:** Check door seal, using knowledge and proper tools, to ensure a good seal of compartments.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools to perform task - | ____ | ____ |
| 2. Checked for gap between door gaskets and cabinet front - | ____ | ____ |
| 3. Loosened gasket retainer screws - | ____ | ____ |
| 4. Adjusted door for proper seal and checked gap - | ____ | ____ |
| 5. Retightened screws until snug - | ____ | ____ |
| 6. Demonstrated acceptable safety habits - | ____ | ____ |
| 7. Cleaned work area and tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 3

**Task:** Install a refrigerant system component, using all necessary tools and equipment, to insure protection of compressor motor from moisture and non-condensables.

**Achievement indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and materials - | ____ | ____ |
| 2. Installed refrigeration gauge set and discharged system - | ____ | ____ |
| 3. Removed old filter/drier from the system correctly - | ____ | ____ |
| 4. Installed new suction filter/drier properly - | ____ | ____ |
| 5. Pressurized system - | ____ | ____ |
| 6. Checked for leaks - | ____ | ____ |
| 7. Discharged holding charge and evacuated the system - | | |
| 8. Recharged system and put into operation properly - | ____ | ____ |
| 9. Removed gauge set and replaced all valve caps - | ____ | ____ |
| 10. Demonstrated acceptable safety habits - | ____ | ____ |
| 11. Cleaned work area and all tools - | ____ | ____ |

**Criteria:**

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 4

**Task:** Install core-type service valves, using proper tools, to evacuate and charge a refrigeration system.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and materials - | ____ | ____ |
| 2. Disconnected system from electrical power - | ____ | ____ |
| 3. Discharged refrigerant from the system - | ____ | ____ |
| 4. Cut the suction line and cleaned the tubing with sandpaper - | ____ | ____ |
| 5. Installed a tee and core-type valve properly and removed core from valve body - | ____ | ____ |
| 6. Demonstrated soldering skills - | ____ | ____ |
| 7. Pressurized system to leak check - | ____ | ____ |
| 8. Discharged refrigerant and evacuated the system - | ____ | ____ |
| 9. Charged system correctly - | ____ | ____ |
| 10. Demonstrated acceptable safety habits - | ____ | ____ |
| 11. Cleaned work area, gauge set, and all tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 5

**Task:** Evacuate a refrigeration or air conditioning system, using all necessary tools and equipment, to ensure that the system is free of air and moisture.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | ____ | ____ |
| 2. Installed refrigeration gauge set properly - | ____ | ____ |
| 3. Discharged any refrigerant in the system - | ____ | ____ |
| 4. Demonstrated proper evaluation procedures - | ____ | ____ |
| 5. Checked oil level in vacuum pump - | ____ | ____ |
| 6. Allowed the system to be evaluated to 29.9" Hg - | ____ | ____ |
| 7. Demonstrated knowledge of vacuum scale - | ____ | ____ |
| 8. Demonstrated acceptable safety habits - | ____ | ____ |
| 9. Cleaned work area, tools and equipment - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Condition Systems

**Duty No.** C

**Task No.** 6

**Task:** Test for leaks on a refrigerator or air conditioning system, using leak detectors, to insure that the system is sealed.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | ____ | ____ |
| 2. Demonstrated the use of the halide torch leak detector - | ____ | ____ |
| 3. Demonstrated the use of an electronic leak detector - | ____ | ____ |
| 4. Demonstrated the use of leak testing with soap solution - | ____ | ____ |
| 5. Demonstrated the use of refrigerant dye - | ____ | ____ |
| 6. Demonstrated acceptable safety habits - | ____ | ____ |
| 7. Cleaned work area and cared for leak testing equipment - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

|  |  |
|---|---|
| **Duty:** Servicing Refrigeration and Air Conditioning Systems | **Duty No.** C<br>**Task No.** 7 |

**Task:** Static charge a refrigeration or air conditioning system, using all necessary tools and equipment, to provide sufficient refrigeration.

**Achievement Indicators:** The learner:

|  | Yes | No |
|---|---|---|
| 1. Selected proper tool and charging equipment - | ____ | ____ |
| 2. Demonstrated knowledge of liquid charging procedures - | ____ | ____ |
| 3. Demonstrated proper use of gauge set - | ____ | ____ |
| 4. Demonstrated proper use of pressure/temperature chart to determine proper charge - | ____ | ____ |
| 5. Referred to data plate to determine charge requirements and refrigerant type - | ____ | ____ |
| 6. Charged system and removed gauge properly - | ____ | ____ |
| 7. Demonstrated acceptable safety habits - | ____ | ____ |
| 8. Cleaned work area and cared for tools and equipment - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 8

**Task:** Take temperature and pressure readings, using proper tools and equipment, to determine system efficiency.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and temperature recording devices - | ____ | ____ |
| 2. Installed gauge set to determine low and high pressure - | ____ | ____ |
| 3. Referred to pressure/temperature chart to determine if pressures were acceptable - | ____ | ____ |
| 4. Recorded evaporator supply - air temperature - | ____ | ____ |
| 5. Calculated temperature difference across the evaporator coil (a/c system only) - | ____ | ____ |
| 6. Demonstrated acceptable safety habits - | ____ | ____ |
| 7. Cleaned work area and cared for all tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 9

**Task:** Adjust a thermostatic expansion valve, using knowledge and proper tools, to insure proper superheat.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and temperature recording instruments - | ____ | ____ |
| 2. Installed gauge set correctly - | ____ | ____ |
| 3. Attached temperature indicator to inlet of evaporator and insulated with foam tape - | ____ | ____ |
| 4. Recorded suction pressure and converted to temperature - | ____ | ____ |
| 5. Recorded refrigerant temperature at evaporator inlet - | ____ | ____ |
| 6. Calculated superheat - | ____ | ____ |
| 7. Demonstrated proper adjustment of expansion valve to insure proper superheat - | ____ | ____ |
| 8. Demonstrated acceptable safety habits - | ____ | ____ |
| 9. Cleaned work area and cared for tools and equipment - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 10

**Task:** Charge an operating system, using refrigerant vapor and all necessary tools, to provide proper cooling.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools and charging equipment - | ____ | ____ |
| 2. Connected refrigeration gauge set to system - | ____ | ____ |
| 3. Evacuated system (if necessary) - | ____ | ____ |
| 4. Purged refrigerant hose at service valve gauge ports - | ____ | ____ |
| 5. Cracked service valves - | ____ | ____ |
| 6. Recorded weight of cylinder - | ____ | ____ |
| 7. Charged system to obtain proper operating temperature - | ____ | ____ |
| 8. Properly disconnected refrigerant cylinder and gauges from the system - | ____ | ____ |
| 9. Recorded weight of cylinder to determine amount of refrigerant used - | ____ | ____ |
| 10. Demonstrated acceptable safety habits - | ____ | ____ |
| 11. Clean work area and cared for tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 11

**Task:** Add oil to a system, using knowledge and proper tools, to insure that proper oil level is maintained in the compressor.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | ____ | ____ |
| 2. Checked oil level to determine if system was low on oil - | ____ | ____ |
| 3. Pumped refrigerant into liquid receiver and allowed system low side to go into a vacuum - | ____ | ____ |
| 4. Demonstrated ability to add refrigeration oil to compressor through low side service valve - | ____ | ____ |
| 5. Returned system to normal operation and checked oil level - | ____ | ____ |
| 6. Demonstrated acceptable safety habits - | ____ | ____ |
| 7. Cleaned work area and cared for tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards..

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Condition Systems

**Duty No.** C

**Task No.** 12

**Task:** Test a hermetic compressor motor, using an ohmmeter and necessary tools, to determine condition of motor windings and valves.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | | |
| 2. Installed refrigeration gauge set correctly - | | |
| 3. Pumped system into a vacuum to determine valve condition (compressor should pump a vacuum of 18" Hg) - | | |
| 4. Checked resistance of the run and start winding correctly - | | |
| 5. Determined condition of winding by referring to manufacturer's handbook - | | |
| 6. Demonstrated acceptable safety habits - | | |
| 7. Cleaned work area and cared for all tools and equipment - | | |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

| | |
|---|---|
| **Duty:** Servicing Refrigeration and Air Conditioning Systems | **Duty No.** C<br>**Task No.** 13 |

**Task:** Adjust a automatic expansion valve, using knowledge and proper tools, to insure proper superheat.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | _____ | _____ |
| 2. Installed manifold gauge set correctly - | _____ | _____ |
| 3. Obtained system operating pressures - | _____ | _____ |
| 4. Determined if pressures were acceptable to system design - | _____ | _____ |
| 5. Adjusted automatic expansion valve to correspond with the refrigerant evaporative temperature - | _____ | _____ |
| 6. Demonstrated acceptable safety habits - | _____ | _____ |
| 7. Cleaned work area and cared for tools and equipment - | _____ | _____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 14

**Task:** Troubleshoot a refrigeration system, using knowledge and proper tools, to determine system malfunction and remedy.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | ____ | ____ |
| 2. Performed proper troubleshooting procedures - | ____ | ____ |
| 3. Used a system approach to solving the problem - | ____ | ____ |
| 4. Demonstrated correct use of testing meter, gauges, and tools - | ____ | ____ |
| 5. Diagnosed system malfunction correctly - | ____ | ____ |
| 6. Demonstrated acceptable safety habits - | ____ | ____ |
| 7. Cleaned work area and cared for tools and equipment - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 15

**Task:** Service a water regulating valve, using knowledge and the proper tools, to provide proper cooling of refrigerant in a water-cooled condenser.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools - | ____ | ____ |
| 2. Installed manifold gauges correctly - | ____ | ____ |
| 3. Cracked service valves to obtain operating pressures - | ____ | ____ |
| 4. Adjusted water regulating valve to maintain condenser temperature - | ____ | ____ |
| 5. Removed gauges - | ____ | ____ |
| 6. Demonstrated acceptable safety habits - | ____ | ____ |
| 7. Cleaned work area and tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 16

**Task:** Replace belts, using all tools necessary, to provide proper belt tension, alignment of pulleys and motor amperage.

**Achievement Indicators:** The learners:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and supplies - | | |
| 2. Removed work belt correctly - | | |
| 3. Installed new belt correctly - | | |
| 4. Checked pulley and flywheel alignment correctly - | | |
| 5. Demonstrated the use of the ammeter by checking motor starting and running amperes - | | |
| 6. Demonstrated acceptable safety habits - | | |
| 7. Cleaned work area and cared for tools and equipment - | | |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 17

**Task:** Replace air filter, using knowledge and tools necessary, to provide clean, filtered air that is returning to the air conditioning system.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and supplies - | ____ | ____ |
| 2. Demonstrated knowledge of filter location in the system - | ____ | ____ |
| 3. Removed dirty filter and checked size - | ____ | ____ |
| 4. Replaced filter correctly - | ____ | ____ |
| 5. Replaced all blower panels correctly - | ____ | ____ |
| 6. Demonstrated acceptable safety habits - | ____ | ____ |
| 7. Cleaned work area and cared for tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

| | |
|---|---|
| **Duty:** Servicing Refrigeration and Air Conditioning Systems | **Duty No.** C<br>**Task No.** 18 |

**Task:** Perform annual maintenance on an air conditioning system, using all the necessary tools, to insure that the system is clean and running at peak efficiency.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | ____ | ____ |
| 2. Operated system correctly - | ____ | ____ |
| 3. Checked: | | |
| a. V-belt - | ____ | ____ |
| b. Blower motor amperage - | ____ | ____ |
| c. Motor lubrication - | ____ | ____ |
| d. Indoor coil (evaporator) - | ____ | ____ |
| e. Outdoor coil - | ____ | ____ |
| f. Condensor motor lubrication - | ____ | ____ |
| g. Condensing unit R.L.A. (amperage) - | ____ | ____ |
| h. High pressure and lower pressure - | ____ | ____ |
| 4. Determined condenser temperature difference - | ____ | ____ |
| 5. Determined evaporator temperature difference - | ____ | ____ |
| 6. Calculated E.E.R. (energy efficient ratio) - | ____ | ____ |
| 7. Demonstrated acceptable safety habits - | ____ | ____ |
| 8. Cleaned work area and cared for tools and equipment - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

| **Tools and Equipment:** | **Resources:** |
|---|---|
| | |

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 19

**Task:** Check performance of an air conditioning system, using knowledge and all necessary tools and equipment, to determine system energy efficiency ratio (EER).

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | ____ | ____ |
| 2. Calculated wattage consumption - | ____ | ____ |
| 3. Determined B.T.U.H. of condensing unit by checking: | | |
| a. C.F.M. of condenser (manufacturer's specifications) - | ____ | ____ |
| b. Temperature difference of coil - | ____ | ____ |
| 4. Computed EER - | ____ | ____ |
| 5. Demonstrated acceptable safety habits - | ____ | ____ |
| 6. Cleaned work area and cared for tools - | ____ | ____ |

$$EER = \frac{BTUH}{Wattage}$$

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 20

**Task:** Wire a refrigeration system, using knowledge, wiring diagrams and necessary tools, to provide comfort cooling.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | ____ | ____ |
| 2. Identified all electrical components correctly - | ____ | ____ |
| 3. Demonstrated competence in using hand tools and meters - | ____ | ____ |
| 4. Demonstrated competence in reading schematic wiring diagrams - | ____ | ____ |
| 5. Wired system correctly - | ____ | ____ |
| 6. Demonstrated acceptable safety habits - | ____ | ____ |
| 7. Cleaned work area and cared for tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 21

**Task:** Install heat-cool thermostat and sub-base, using all necessary tools, to provide temperature control of a conditioned space.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools - | ____ | ____ |
| 2. Listed installation "do's and don'ts" for thermostats - | ____ | ____ |
| 3. Properly mounted switching sub-base on interior wall at correct height - | ____ | ____ |
| 4. Connected necessary low-voltage wire - | ____ | ____ |
| 5. Mounted thermostat on sub-base - | ____ | ____ |
| 6. Checked thermostat adjustment and adjusted if necessary - | ____ | ____ |
| 7. Checked amp draw of low voltage circuit and set heat anticipator - | ____ | ____ |
| 8. Demonstrated acceptable safety habits - | ____ | ____ |
| 9. Cleaned work area and cared for tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Re[illegible]ences:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 22

**Task:** Apply psychrometric charts, using the necessary test instruments and knowledge, to determine air sample conditions and system performance information.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools - | ____ | ____ |
| 2. Measured dry-bulb and wet-bulb temperatures of a conditioned space using a sling-psychrometer - | ____ | ____ |
| 3. Determined relative humidity level by using psychrometric charts - | ____ | ____ |
| 4. Obtained velocity readings at evaporation discharge - | ____ | ____ |
| 5. Calculated CFM - | ____ | ____ |
| 6. Determined heat exchanger contact factor - | ____ | ____ |
| 7. Determined system performance by psychometric chart - | ____ | ____ |
| 8. Demonstrated acceptable safety habits - | ____ | ____ |
| 9. Cleaned work area and cared for tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 23

**Task:** Install an air conditioning system, using proper tools, equipment and recommended installation practice, to manufacturer and industry specifications.

**Achievement indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | ____ | ____ |
| 2. Set the condensing unit on pad and leveled - | ____ | ____ |
| 3. Installed evaporator coil in furnace plenum correctly - | ____ | ____ |
| 4. Installed liquid line and drier correctly - | ____ | ____ |
| 5. Installed suction line and drier correctly - | ____ | ____ |
| 6. Wired low voltage thermostat control correctly - | ____ | ____ |
| 7. Installed condenstate drain correctly - | ____ | ____ |
| 8. Demonstrated acceptable safety habits - | ____ | ____ |
| 9. Cleaned work area and cared for tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 24

**Task:** Treat cooling water, using chemicals and cleaning equipment, to insure proper water quality.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools and supplies - | ____ | ____ |
| 2. Inspected cooling tower - | ____ | ____ |
| 3. Demonstrated correct use of cleaning equipment - | ____ | ____ |
| 4. Treated the water as specified on instructions - | ____ | ____ |
| 5. Demonstrated acceptable safety habits - | ____ | ____ |
| 6. Cleaned work area and cared for tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 2

**Task:** Service cooling towers, using necessary tools and equipment, to insure proper water cooling operations.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | ____ | ____ |
| 2. Checked spray heads and cleaned, if necessary - | ____ | ____ |
| 3. Checked fan motor (bearings, lubrication, v-belt) - | ____ | ____ |
| 4. Checked flat operation and adjusted, if necessary - | ____ | ____ |
| 5. Checked "fill" material for deterioration - | ____ | ____ |
| 6. Checked immersion or convection heater (if used) - | ____ | ____ |
| 7. Checked pump motor operation - | ____ | ____ |
| 8. Demonstrated acceptable safety habits - | ____ | ____ |
| 9. Cleaned work area and cared for tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 26

**Task:** Service heat exchangers, using necessary tools, to insure proper heat exchange.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | ____ | ____ |
| 2. Checked system operating procedures - | ____ | ____ |
| 3. Inspected heat exchangers - | ____ | ____ |
| 4. Demonstrated correct acid cleaning procedures (water cooled) - | ____ | ____ |
| 5. Checked fan motor (air cooled) | | |
| a. Lubrication - | ____ | ____ |
| b. Amperage - | ____ | ____ |
| c. Bearing - | ____ | ____ |
| d. Cleaning - | ____ | ____ |
| 6. Demonstrated acceptable safety habits - | ____ | ____ |
| 7. Cleaned work area and cared for tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

**Tools and Equipment:**

**Resources:**

| | | | |
|---|---|---|---|
| **Duty:** | Servicing Refrigeration and Air Conditioning Systems | **Duty No.** | C |
| | | **Task No.** | 27 |

**Task:** Service absorption systems, using appropriate tools and knowledge, to insure proper operation.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Selected proper tools and equipment - | ____ | ____ |
| 2. Checked gas supply pressure using a water filled manometer, correctly - | ____ | ____ |
| 3. Cleaned the flue with wire brush - | ____ | ____ |
| 4. Checked fluids level - | ____ | ____ |
| 5. Cleaned fins on condenser - | ____ | ____ |
| 6. Checked motor and pumps - | ____ | ____ |
| 7. Operated system and determined if further service was needed - | ____ | ____ |
| 8. Demonstrated acceptable safety habits - | ____ | ____ |
| 9. Cleaned work area and cared for tools - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to trade standards.

| **Tools and Equipment:** | **Resources:** |
|---|---|
| | |

**Duty:** Servicing Refrigeration and Air Conditioning Systems

**Duty No.** C

**Task No.** 28

**Task:** Service centrifugal systems, using necessary tools and test equipment, to insure proper operation.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Checked operating pressures and temperatures of refrigerant system - | ____ | ____ |
| 2. Checked operating pressures and temperatures of cooling medium to condensor section - | ____ | ____ |
| 3. Checked operating pressures and temperatures of chilled medium from evaporator section - | ____ | ____ |
| 4. Checked operating voltage and amperage - | ____ | ____ |
| 5. Checked oil level - | ____ | ____ |
| 6. Checked refrigerant charge - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

|  |  |
|---|---|
| **Duty:** Servicing Pneumatic Systems | **Duty No.** D<br>**Task No.** 1 |

**Task:** Check operating pressures, using correct test instruments, to insure proper operating pressures.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Checked for day mode operating pressures specific to the system under test - | ____ | ____ |
| 2. Adjusted day mode regulator for correct pressure - | ____ | ____ |
| 3. Checked for night mode operating pressures specific to the system under test - | ____ | ____ |
| 4. Adjusted night mode regulator for correct pressure - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

| **Tools and Equipment:** | **Resources:** |
|---|---|
|  |  |

| Teacher Activities | Student Learning Activities |
|---|---|
| 1. Cover day and night mode operation and set-back controls. | 1. Read handout material. |
| 2. Handout information on pressure regulators. | 2. Study the pressure regulator construction. |
| 3. Explain the procedures in taking pressures. | 3. Take a pressure reading. |
| 4. Demonstrate pressure measurement. | 4. Adjust pressure to given pressure. |
| 5. Demonstrate changing the pressure. | |
| 6. Discuss safety procedures. | |

| | |
|---|---|
| **Duty:** Servicing Pneumatic Systems | **Duty No.** D<br>**Task No.** 2 |

**Task:** Service pneumatic controls, using proper tools, to insure proper operation and calibration.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Measured control input pressure - | ____ | ____ |
| 2. Adjusted input pressure - | ____ | ____ |
| 3. Measured control output pressure to controlled device - | ____ | ____ |
| 4. Adjusted control output pressure to match ambient condition (pressure, temperature, humidity) specific to the control under test - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

| **Tools and Equipment:** | **Resources:** |
|---|---|

**Duty:** Servicing Pneumatic Systems

**Duty No.** D

**Task No.** 3

**Task:** Service pneumatic controlled devices, using appropriate tools, to insure proper operation and adjustment.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Measured input to the controlled device - | ____ | ____ |
| 2. Adjusted linkage to the appropriate position relative to the control pressure and the manufacturer's specifications or the requirements of the job, i.e., CFM, temperature or Gpm - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Pneumatic Systems

**Duty No.** D

**Task No.** 4

**Task:** Service air driers, using correct tools and service procedures, to manufacturer's specifications.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Checked for type of air drier, desicant or refrigerant - | ____ | ____ |
| 2. Checked moisture count, relative humidity on moisture indicator - | ____ | ____ |
| 3. Replaced desicant if output moisture count was high - | ____ | ____ |
| 4. Checked for operation of refrigerant drier if moisture count was high - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

| | |
|---|---|
| **Duty:** Servicing Pneumatic Systems | **Duty No.** D<br>**Task No.** 5 |

**Task:** Service air compressors, using necessary tools and service manuals, to insure proper operation.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Checked temperature of heat exchange coils - | ____ | ____ |
| 2. Checked compressor operation - | ____ | ____ |
| 3. Checked electrical supply - | ____ | ____ |
| 4. Checked operating pressure of refrigerant system - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

| **Tools and Equipment:** | **Resources:** |
|---|---|
| | |

| | |
|---|---|
| **Duty:** Servicing Electronic Systems | **Duty No.** E<br>**Task No.** 1 |

**Task:** Service electronic controls, using appropriate tools and test meters, to insure proper operation.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Measured input voltage - | ____ | ____ |
| 2. Measured output voltage - | ____ | ____ |
| 3. Indicated correct logic output with given input - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

| | |
|---|---|
| **Tools and Equipment:** | **Resources:** |

| Teacher Activities | Student Learning Activities |
|---|---|
| 1. Discuss several electronic controls and draw the similarities to the students' attention.<br>2. Handout manufacturer's literature on several controls.<br>3. Demonstrate the checkout procedure outlined by manufacturer.<br>4. Discuss the differences in service procedures.<br>5. Discuss safety procedures. | 1. Study handout material.<br>2. Perform the checkout as detailed by manufacturer.<br>3. Perform numerous checkouts on different controls. |

| | |
|---|---|
| **Duty:** Servicing Electronic Systems | **Duty No.** E<br>**Task No.** 2 |

**Task:** Service energy management control systems, using necessary tools and test meters, to insure proper operation.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Programmed for proper sequential operation given a set of criteria - | ____ | ____ |
| 2. Determined optimum energy program given a set of criteria - | ____ | ____ |
| 3. Connected input and output devices - | ____ | ____ |
| 4. Measured input and output voltages - | ____ | ____ |
| 5. Checked for proper logic operation - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications and recommendations.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Electronic Systems

**Duty No.** E

**Task No.** 3

**Task:** Service electronic timing devices, using appropriate tools and test meters, to determine proper operation.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Measured input and output voltages - | ____ | ____ |
| 2. Measured timing sequence - | ____ | ____ |
| 3. Wired the timing device - | ____ | ____ |
| 4. Changed timing sequence on adjustable timer - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Electronic Systems

**Duty No.** E

**Task No.** 4

**Task:** Service solid state control boards, using necessary test instruments, to insure proper input and output levels.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Checked visually for cracked conductors, lose wires, burned components, or any other inconsistencies - | ____ | ____ |
| 2. Checked continuity of connectors - | ____ | ____ |
| 3. Measured input voltage - | ____ | ____ |
| 4. Measured output voltage - | ____ | ____ |
| 5. Determined operability of board - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

| **Tools and Equipment:** | **Resources:** |
|---|---|
|  |  |

**Duty:** Servicing Electronic Systems

**Duty No.** E

**Task No.** 5

**Task:** Service electronic sensing devices, using proper test instruments, to determine correct output levels.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Measured sensor ambient, voltage, amperage, wattage, temperature, humidity, or pressure - | ____ | ____ |
| 2. Measured sensor response output - | ____ | ____ |
| 3. Calibrated control or sensor for correct response to ambient - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

| | |
|---|---|
| **Duty:** Fabricating Duct Systems | **Duty No.** F<br>**Task No.** 1 |

**Task:** Fabricate sheet metal fittings, using necessary tools and equipment, to form the fitting to correct specifications.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Scribed pattern layout - | ____ | ____ |
| 2. Measured gross pattern allowances - | ____ | ____ |
| 3. Cut pattern - | ____ | ____ |
| 4. Formed pattern into fitting - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to accepted industry practice and procedures.

**Tools and Equipment:**

**Resources:**

| Teacher Activities | Student Learning Activities |
|---|---|
| 1. Demonstrate scribing technique. | 1. Scribe pattern. |
| 2. Demonstrate cutting and trimming. | 2. Cut out pattern. |
| 3. Demonstrate forming process. | 3. Form pattern into finished fitting. |
| 4. Discuss safety procedures. | |

**Duty:** Fabricating Duct Systems

**Duty No.** F

**Task No.** 2

**Task:** Fabricate duct board fittings, using appropriate duct board tools, to form the fitting to correct tolerances.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Measured proper duct size and added cut allowances - | | |
| 2. Selected correct tool for the cut - | | |
| 3. Folded and stapled - | | |
| 4. Taped seam - | | |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to industry standards and manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

| | |
|---|---|
| **Duty:** Fabricating Duct Systems | **Duty No.** F<br>**Task No.** 3 |

**Task:** Install ducting, using appropriate tools, to conform to installation practices.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Determined and used appropriate duct connectors - | ____ | ____ |
| 2. Determined and used appropriate duct hanging material - | ____ | ____ |
| 3. Leveled and straightened installation as installed - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to accepted industry practice and coding regulations.

| | |
|---|---|
| **Tools and Equipment:** | **Resources:** |

**Duty:** Fabricating Duct Systems

**Duty No.** F

**Task No.** 4

**Task:** Install diffusers and grill, using necessary tools, to conform to industry standards.

**Achievement Indicators:** The learner: Yes No

1. Determined proper boot for diffuser application - ____ ____
2. Cut-in cold air passages and attached return air grills - ____ ____
3. Connected diffusers to boots - ____ ____
4. Installed appropriate diffuser accessories - ____ ____

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to accepted industry practice and coding requirements.

**Tools and Equipment:**

**Resources:**

**Duty:** Fabricating Duct Systems

**Duty No.** F

**Task No.** 5

**Task:** Measure air properties, using appropriate test instruments, to determine the conditions that exist.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Measured air velocity directly - | ____ | ____ |
| 2. Measured air velocity pressure - | ____ | ____ |
| 3. Determined air velocity from velocity pressure - | ____ | ____ |
| 4. Measured air temperature in wet and dry bulb - | ____ | ____ |
| 5. Plotted air condition point on psychrometric chart - | ____ | ____ |
| 6. Determined mixed air conditions - | ____ | ____ |
| 7. Determined the (SHR) sensible heat ratio - | ____ | ____ |
| 8. Determined (DP) dew point or apparatus dew point - | ____ | ____ |
| 9. Determined actual heat removal with contact factor - | ____ | ____ |
| 10. Determined RH (relative humidity) - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to acceptable industry practice.

**Tools and Equipment:**

**Resources:**

**Duty:** Fabricating Duct Systems

**Duty No.** F

**Task No.** 6

**Task:** Draft fittings, using drafting equipment and methods, to construct a pattern or plan for fittings.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Drew straight and curved lines - | ____ | ____ |
| 2. Measured to scale - | ____ | ____ |
| 3. Followed written instructions - | ____ | ____ |
| 4. Drew light consutrction lines and dark viewing lines - | ____ | ____ |
| 5. Completed the net pattern - | ____ | ____ |
| 6. Added gross pattern allowances - | ____ | ____ |
| 7. Labled all bends and cuts - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to accepted industry standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Designing Systems

**Duty No.** G

**Task No.** 1

**Task:** Read blueprints, using appropriate prints and knowledge, to locate specific building components.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Identified building components - | _____ | _____ |
| 2. Used correct terminology to describe components - | _____ | _____ |
| 3. Identified electrical systems - | _____ | _____ |
| 4. Identified plumbing systems - | _____ | _____ |
| 5. Identified mechanical systems - | _____ | _____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to industry standards.

**Tools and Equipment:**

**Resources:**

| Teacher Activities | Student Learning Activities |
|---|---|
| 1. Discuss blueprint uses and value. | 1. Study blueprint. |
| 2. Discuss terminology and type of construction. | 2. Idenitfy construction detail. |
| 3. Handout sample blueprints. | 3. Ascertain construction data. |
| 4. Assign students to locate construction data. | |

|  |  |
|---|---|
| **Duty:** Designing Systems | **Duty No.** G |
|  | **Task No.** 2 |

**Task:** Calculate heat gain/loss, using appropriate blueprints and data, to determine the amount of heat movement.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Determined BTU loss/gain for individual building components - | ____ | ____ |
| 2. Determined infiltration - | ____ | ____ |
| 3. Determined make-up air requirements - | ____ | ____ |
| 4. Determined solar gain - | ____ | ____ |
| 5. Determined degree day loss/gain estimate - | ____ | ____ |
| 6. Determine balance point using the bin method - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to ACCA or Hydronics Institute criteria.

| **Tools and Equipment:** | **Resources:** |
|---|---|
|  |  |

**Duty:** Designing Systems

**Duty No.** G

**Task No.** 3

**Task:** Calculate duct size, using appropriate design booklets and knowledge, to layout ducting and size runs.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Designed ducting layout and furnace location - | ____ | ____ |
| 2. Determined static pressure loss - | ____ | ____ |
| 3. Determined CFM - | ____ | ____ |
| 4. Determined fittings required - | ____ | ____ |
| 5. Sized supply and return runs and trunk ducts - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to ACCA or ASHREA specifications.

**Tools and Equipment:**

**Resources:**

|  |  |
|---|---|
| **Duty:** Designing Systems | **Duty No.** G |
|  | **Task No.** 4 |

**Task:** Calculate pipe size, using appropriate tables and graphs, to determine correct size.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Determined fluid flow - | ____ | ____ |
| 2. Determined length of run - | ____ | ____ |
| 3. Selected fittings required - | ____ | ____ |
| 4. Calculated effective length - | ____ | ____ |
| 5. Sized pipe required for flow and pressure drop desired - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to AGA for gas and Hydronics Institute for hot water.

**Tools and Equipment:**

**Resources:**

**Duty:** Designing Systems

**Duty No.** G

**Task No.** 5

**Task:** Calculate product load, using product data sheets and knowledge of latent and sensible heat, to determine heat load within an enclosure.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Determined amount of product - | ____ | ____ |
| 2. Determined properties of the product, i.e., specific gravity, specific heat, respiration, latent heat, freeze point, etc. - | ____ | ____ |
| 3. Calculated product load based on the product cooling requirements - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to ASHREA.

**Tools and Equipment:**

**Resources:**

**Duty:** Designing Systems

**Duty No.** G

**Task No.** 6

**Task:** Select equipment, using heat load and design data, to identify components necessary to deliver designed system performance.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Selected appropriately sized equipment - | ____ | ____ |
| 2. Determined the best application for a particular set of criteria - | ____ | ____ |
| 3. Determined accessories needed for installation - | ____ | ____ |
| 4. Determined power required for operation - | ____ | ____ |
| 5. Determined fuel distribution or supply required - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to industry standards and coding requirements.

**Tools and Equipment:**

**Resources:**

**Duty:** Designing Systems

**Duty No.** G

**Task No.** 7

**Task:** Prepare bid proposal, using selected equipment and information on costs (overhead and job related), to determine retail cost of equipment installation.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Priced the equipment - | ____ | ____ |
| 2. Priced the supply items - | ____ | ____ |
| 3. Determined the permit fees - | ____ | ____ |
| 4. Estimated the time and labor - | ____ | ____ |
| 5. Estimated the overhead for a particular type of business - | ____ | ____ |
| 6. Estimated the amount of profit - | ____ | ____ |
| 7. Detailed the type, style, and features of the equipment and plan purposed - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to industry standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Designing Systems

**Duty No.** G

**Task No.** 8

**Task:** Calculate solar insolance, using appropriate climatic data, to obtain amounts of heat per square foot on a surface.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Obtained data for given surface angle in BTU's per square foot from chart - | ____ | ____ |
| 2. Obtained data for given surface angle in Langly's - | ____ | ____ |
| 3. Calculated surface area in english and metric units - | ____ | ____ |
| 4. Determined total energy amounts in both BTU's and Langly's - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to industry standards.

**Tools and Equipment:**

**Resources:**

|  |  |
|---|---|
| **Duty:** Servicing Electrical Components | **Duty No.** H |
|  | **Task No.** 1 |

**Task:** Demonstrate the use of test meters, using selected test instruments, to determine values of electricity.

**Achievement Indicators:** The learner:

|  | Yes | No |
|---|---|---|
| 1. Used appropriate meter for the intended measurement - | ____ | ____ |
| 2. Measured to within the accuracy capability of the test instrument - | ____ | ____ |
| 3. Determined the appropriate scale - | ____ | ____ |
| 4. Read the scale accurately - | ____ | ____ |
| 5. Attached the meter correctly - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to industry standards.

**Tools and Equipment:**

**Resources:**

| **Teacher Activities** | **Student Learning Activities** |
|---|---|
| 1. Assign chapter: Chapter on Electric Meters. | 1. Read chapter on Electric Meters. |
| 2. Discuss AC and DC meters. | 2. Study the construction of the two meters. |
| 3. Discuss Ohm's Law. | 3. Identify the correct scale. |
| 4. Demonstrate electrical connection of DC meter. | 4. Measure DC amperage. |
| 5. Demonstrate use of AC meter. | 5. Measure AC amperage. |
| 6. Assign lab. | 6. Calculate amerage using Ohm's Law. |

| Teacher Activities | Student Learning Activities |
|---|---|
| 1. Assign chapter in test: chapter on electric meters. | 1. Read chapter on electric meters. |
| 2. Discuss the voltage scales and meter selector switch. | 2. Study the construction of the meter. |
| 3. Demonstrate AC and DC voltage test. | 3. Study selector switch setting to scale. |
| 4. Emphasize polarity of DC. | 4. Measure DC voltage. |
| 5. Demonstrate reverse polarity reading problem. | 5. Measure AC voltage. |
| 6. Assign lab. | |

| | |
|---|---|
| **Duty:** Servicing Electrical Components | **Duty No.** H |
| | **Task No.** 2 |

**Task:** Service capacitors, using appropriate test meters, to determine the condition of the capacitors.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Measured uf (micro farads) with a capacitor testor - | ____ | ____ |
| 2. Measured uf with volt and amp meters - | ____ | ____ |
| 3. Measured for short or open using ohmmeter - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to industry standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Electrical Components

**Duty No.** H

**Task No.** 3

**Task:** Service relays/contractors, using necessary test instruments, to insure proper operation.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Measured continuity of coil and contacts - | ____ | ____ |
| 2. Measured resistance across the contacts - | ____ | ____ |
| 3. Checked for short to ground - | ____ | ____ |
| 4. Checked mechanical movement where possible - | ____ | ____ |
| 5. Tested operation under power - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to industry practice.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Electrical Components

**Duty No.** H

**Task No.** 4

**Task:** Service motors, using knowledge and all necessary tools, to determine condition of motor windings.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Checked motor continuity - | ____ | ____ |
| 2. Checked for short to ground - | ____ | ____ |
| 3. Determined start and run windings - | ____ | ____ |
| 4. Checked bearings and lubrication - | ____ | ____ |
| 5. Checked brushes and commutator where appropriate - | ____ | ____ |
| 6. Checked for motor operation under power - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to industry practice.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Electrical Components

**Duty No.** H

**Task No.** 5

**Task:** Service controls, using knowledge and necessary tools, to determine operating condition.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Measured input and output voltage - | _____ | _____ |
| 2. Measured control sensing ambient - | _____ | _____ |
| 3. Measured resistance across the contacts - | _____ | _____ |
| 4. Determined correct operation under load - | _____ | _____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to industry practice.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Electrical Components

**Duty No.** H

**Task No.** 6

**Task:** Service heaters, using volt-ohmmeter and necessary tools, to determine operating condition.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Determined continuity - | ____ | ____ |
| 2. Determined short to ground - | ____ | ____ |
| 3. Checked all electrical connections - | ____ | ____ |
| 4. Checked heater mounts - | ____ | ____ |
| 5. Checked for heater operation under power - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to industry practice.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Electrical Components

**Duty No.** H

**Task No.** 7

**Task:** Service transformers, using volt-ohmmeter and all necessary tools, to determine voltage output.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Checked input and output voltage - | ____ | ____ |
| 2. Checked continuity on primary and secondary - | ____ | ____ |
| 3. Checked for short to ground - | ____ | ____ |
| 4. Checked VA output to devices served - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to industry practice.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Electrical Components

**Duty No.** H

**Task No.** 8

**Task:** Trouble shoot, using appropriate test instruments and hand tools, to ascertain the source of the problem.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Followed a step-by-step procedure - | ____ | ____ |
| 2. Made logical deductions - | ____ | ____ |
| 3. Used meters and test instruments correctly - | ____ | ____ |
| 4. Demonstrated acceptable safety habits - | ____ | ____ |
| 5. Made a conclusion based on test data gathered during investigation - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to industry practice.

**Tools and Equipment:**

**Resources:**

| | |
|---|---|
| **Duty:** Servicing Gas Burners | **Duty No.** I<br>**Task No.** 1 |

**Task:** Test gas valve operation, using proper test instruments, to insure proper operation.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Checked for correct gas pressure - | ____ | ____ |
| 2. Checked flame safeguard circuit for proper operation (thermocouple, pressure switch, or rectification) - | ____ | ____ |
| 3. Checked for valve leakage - | ____ | ____ |
| 4. Adjusted gas pressure - | ____ | ____ |
| 5. Checked pilot or rectification probe for proper alignment - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are performed successfully according to manufacturer's specifications.

| | |
|---|---|
| **Tools and Equipment:** | **Resources:** |

| Teacher Activities | Student Learning Activities |
|---|---|
| 1. Show Honeywell Film on the gas valve train. | 1. Read chapter on gas valves. |
| 2. Assign reading: chapter on gas valves. | 2. Study the different safety devices. |
| 3. Demonstrate the check-out procedure for gas valves. | 3. Test a thermocouple. |
| 4. Explain the check of a thermocouple. | 4. Manipulate the gas control. |
| 5. Explain the different safety shut-off devices. | 5. Measure gas pressure. |
| 6. Demonstrate use of the "U" tube manometer. | 6. Adjust gas pressure. |
| 7. Assign lab. | |

| | |
|---|---|
| **Duty:** Servicing Gas Burners | **Duty No.** I<br>**Task No.** 2 |

**Task:** Check ignition circuit, using correct test instruments, to insure for proper ignition.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Checked ignition probe for proper alignment - | ____ | ____ |
| 2. Checked for proper voltages - | ____ | ____ |
| 3. Checked for proper ignition sequence - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Gas Burners

**Duty No.** I

**Task No.** 3

**Task:** Derate or change over a gas burner, using correct orfice size, to insure the proper input is obtained.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Removed orfices and guaged size - | ____ | ____ |
| 2. Recorded name plate input reading - | ____ | ____ |
| 3. Determined by chart, correct orfice size for derating - | ____ | ____ |
| 4. Determined by chart, correct change over orfice size - | ____ | ____ |
| 5. Replaced burner and pilot orfices - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Gas Burners

**Duty No.** I

**Task No.** 4

**Task:** Check and adjust gas gun, using correct tools and procedures, to insure proper operation.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Checked gas pressures - | ____ | ____ |
| 2. Checked for proper ignition sequence - | ____ | ____ |
| 3. Checked pilot (when applicable) - | ____ | ____ |
| 4. Checked orfice size for proper firing rate - | ____ | ____ |
| 5. Checked combustion chamber - | ____ | ____ |
| 6. Checked barometric damper (when applicable) - | ____ | ____ |
| 7. Checked safety shut-down - | ____ | ____ |
| 8. Adjusted air dampers - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's standards.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Gas Burners

**Duty No.** I

**Task No.** 5

**Task:** Check and adjust atmospheric injection burners, using correct test instruments, to insure proper operation.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Checked gas pressure - | ____ | ____ |
| 2. Adjusted primary air - | ____ | ____ |
| 3. Checked for proper pilot operation (when applicable) - | ____ | ____ |
| 4. Checked for correct flame - | ____ | ____ |
| 5. Checked for cracked burners - | ____ | ____ |
| 6. Checked for safety shut-down - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Oil Burners

**Duty No.** J

**Task No.** 1

**Task:** Service primary controls, using necessary tools and test equipment, to check for proper operation and safety limit.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Checked voltage input and output - | ____ | ____ |
| 2. Checked safety lock-out timer - | ____ | ____ |
| 3. Checked intermitent ignition when applicable - | ____ | ____ |
| 4. Checked wire connections - | ____ | ____ |
| 5. Wired primary control - | ____ | ____ |
| 6. Checked flame detector - | ____ | ____ |
| 7. Checked and sequenced pyrostat detector when applicable - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to industry practice and manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

| Teacher Activities | Student Learning Activities |
|---|---|
| 1. Assign chapter on primaries. | 1. Read chapter. |
| 2. Discuss the different types of primaries. | 2. Study different types. |
| 3. Demonstrate the check-out procedure. | 3. Check-out a primary of each type. |
| 4. Discuss the sequential operation. | 4. Detach and reinstall a primary control |
| 5. Assign extra reading from Honeywell pamphlets. | |
| 6. Assign lab. | |

**Duty:** Servicing Oil Burners

**Duty No.** J

**Task No.** 2

**Task:** Check and adjust high/low pressure gun, using correct test instruments and procedures, to insure proper operation.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Checked combustion chamber - | ____ | ____ |
| 2. Checked nozzle capacity, angle and pattern - | ____ | ____ |
| 3. Checked and adjusted electrodes - | ____ | ____ |
| 4. Checked ignition transformer input and output - | ____ | ____ |
| 5. Checked and adjusted fuel unit pressure for correct BTU input - | ____ | ____ |
| 6. Checked motor lubrication - | ____ | ____ |
| 7. Checked cadicell operation - | ____ | ____ |
| 8. Checked primary control sequence and safety shutdown - | ____ | ____ |
| 9. Checked flame pattern for inpingement - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

| | |
|---|---|
| **Duty:** Servicing Oil Burners | **Duty No.** J |
| | **Task No.** 3 |

**Task:** Check and adjust vaporizing burners, using correct tools and procedures, to insure proper operation.

**Achievement Indicators:** The learner: Yes No

1. Recorded proper input rate from data tag - ____ ____
2. Calibrated metering device for proper flow - ____ ____
3. Checked retorte' for cracks - ____ ____
4. Checked for overflow shutoff - ____ ____
5. Checked for solenoid operation (when applicable) - ____ ____
6. Checked for proper air adjustment - ____ ____
7. Checked for correct burn - ____ ____

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully completed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Forced Air Systems

**Duty No.** K

**Task No.** 1

**Task:** Service fan and limit control, using appropriate test instruments, to check for proper operation and safety limit.

**Achievement Indicators:** The learner: Yes No

1. Checked voltage input and output - _____ _____
2. Checked Bonnet temperature and correlated control operation - _____ _____
3. Checked safety limit for operation - _____ _____
4. Checked for correct control application - _____ _____

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully completed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

| Teacher Activities | Student Learning Activities |
|---|---|
| 1. Assign reading on fan and limit controls.<br>2. Discuss the operation of the fan control.<br>3. Discuss the necessity of the limit.<br>4. Cover the setting of temperatures on both switches.<br>5. Cover how they are tied into the system electrically.<br>6. Assign lab. | 1. Read the assignment.<br>2. Study the operation.<br>3. Write a synopsis of what was given in lecture.<br>4. Manipulate and reset the control. |

**Duty:** Servicing Forced Air Systems

**Duty No.** K

**Task No.** 2

**Task:** Install a humidifier, using the proper tools, diagram, and recommended installation practices, to manufacturer's specifications.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Located proper placement for specific unit - | ____ | ____ |
| 2. Connected water and drain connections - | ____ | ____ |
| 3. Connected power connections - | ____ | ____ |
| 4. Operated unit under power - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Forced Air Systems

**Duty No.** K

**Task No.** 3

**Task:** Check blower components, using correct tools, to insure proper operating characteristics.

**Achievement Indicators:** The learner: Yes No

1. Checked and replaced blower belts - ____ ____
2. Checked motor for proper amperage draw - ____ ____
3. Checked for correct start and run operation - ____ ____
4. Checked for out of balance conditions or unusual vibration - ____ ____
5. Checked and adjusted for proper belt alignment - ____ ____
6. Checked for "dead" motor mounts - ____ ____
7. Checked for good wire condition between control and motor - ____ ____

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully completed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Forced Air Systems

**Duty No.** K

**Task No.** 4

**Task:** Check operation of fan center, using correct test instruments, to insure proper operation.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Checked supply voltages - | ____ | ____ |
| 2. Checked relay operation for summer and winter position - | ____ | ____ |
| 3. Checked voltage drop across the switch - | ____ | ____ |
| 4. Checked wiring against furnace schematic - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Hydronic Systems

**Duty No.** L

**Task No.** 1

**Task:** Check circulator, using proper procedures and tools, to insure proper operation.

**Achievement Indicators:** The learner: Yes No

1. Checked amp draw against name plate - ____ ____
2. Checked for proper lubrication at wick and motor - ____ ____
3. Checked for leakage at mechanical seal and pipe connections - ____ ____
4. Checked for any unusual noise of vibration - ____ ____
5. Checked for proper motor to impeller shaft - ____ ____
6. Checked for proper wiring - ____ ____

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

| Teacher Activities | Student Learning Activities |
|---|---|
| 1. Assign reading on circulators. | 1. Read assignment. |
| 2. Demonstrate the testing of a circulator. | 2. Test a circulator. |
| 3. Demonstrate the lubrication check at pump seal wick. | 3. Check for lubrication. |
| 4. Discuss noise generation. | 4. Check for noise. |
| 5. Assign lab. | |

**Duty:** Servicing Hydronic Systems

**Duty No.** L

**Task No.** 2

**Task:** Service hydronic aquastat control, using test meters and appropriate tools, to check for proper operation and adjustment.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Checked water temperature against control operation - | ____ | ____ |
| 2. Checked control voltages - | ____ | ____ |
| 3. Checked for correct control sequence - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully completed according to the manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Hydronic Systems

**Duty No.** L

**Task No.** 3

**Task:** Check operation of pressure/temperature gauge, using proper procedures, to insure for correct operation.

**Achievement Indicators:** The learner: Yes No

1. Checked operating tempers with another thermometer at supply tap - ____ ____
2. Checked gauge operation for smooth movement of gauge needles - ____ ____
3. Set altitude/pressure needle at correct pressure reference - ____ ____

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully completed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Hydronic Systems

**Duty No.** L

**Task No.** 4

**Task:** Check and adjust the pressure reducing valve, using the correct tools, to insure proper operation.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Determined the vertical column of water above the valve - | ____ | ____ |
| 2. Set the valve according to calculated press - | ____ | ____ |
| 3. Checked for proper pressure setting at pressure gauge - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully completed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Hydronic Systems

**Duty No.** L

**Task No.** 5

**Task:** Check operation of expansion tank, using correct test instruments, to insure proper operation.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Checked tank pressure (bladder type) - | ____ | ____ |
| 2. Checked for liquid level (standard type) - | ____ | ____ |
| 3. Checked for proper operation as boiler is brought to temperature - | ____ | ____ |
| 4. Checked for proper auxillary controls (airtrol for standard, air vent for bladder) - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Hydronic Systems

**Duty No.** L

**Task No.** 6

**Task:** Check zone valve, using proper procedures and test instruments, to insure correct operation.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Checked voltage to control - | ____ | ____ |
| 2. Checked end switch operation - | ____ | ____ |
| 3. Checked valve operation - | ____ | ____ |
| 4. Checked for valve leakage - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully completed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing Hydronic Systems

**Duty No.** L

**Task No.** 7

**Task:** Check safety controls, using correct procedure and gauges, to insure proper operation.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Checked for valve leakage - | ____ | ____ |
| 2. Checked valve seat by manually opening valve - | ____ | ____ |
| 3. Checked valve setting data plate for valve pressure - | ____ | ____ |
| 4. Checked valve discharge pipe for blockage or restrictions - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing General Heating Systems

**Duty No.** M

**Task No.** 1

**Task:** Perform a combustion test, using a combustion test kit, to determine burner efficiency.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Checked oil pressure - | | |
| 2. Measured stack temperature - | | |
| 3. Measured $CO_2$ - | | |
| 4. Measured draft - | | |
| 5. Sampled flue gas for smoke - | | |
| 6. Adjusted oil pressure to correct firing rate of unit - | | |
| 7. Adjusted "over fire" draft to .02" wc - | | |
| 8. Adjsuted $CO_2$ for highest percentage - | | |
| 9. Calculated combustion efficiency for highest percentage - | | |
| 10. Adjusted primary air dampers - | | |
| 11. Adjust gas pressure - | | |
| 12. Measure CO for acceptable limits - | | |
| 13. Measure $O_2$ - | | |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to Bacharach or Dwyer.

**Tools and Equipment:**

**Resources:**

| Teacher Activities | Student Learning Activities |
|---|---|
| 1. Handout information from Bacharach. | 1. Read handout. |
| 2. Cover uses and operation of testing equipment. | 2. Familiarize the equipment. |
| 3. Demonstrate an actual combustion test. | 3. Conduct a simple test. |
| 4. Select a student to perform the test. | 4. Discuss the test results. |
| 5. Discuss adjustments made and their ramifications. | 5. Conduct further tests to improve efficiency. |
| 6. Discuss safety procedures. | |
| 7. Demonstrate both gas and oil test. | |
| 8. Assign lab. | |

**Duty:** Servicing General Heating Systems

**Duty No.** M

**Task No.** 2

**Task:** Wire a heating system, using appropriate schematic, tools, and knowledge, to manufacturer's specifications.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Checked manufacturer's wiring diagram - | ____ | ____ |
| 2. Checked component layout or types of components - | ____ | ____ |
| 3. Connected color-coded wires to components - | ____ | ____ |
| 4. Checked continuity before operating - | ____ | ____ |
| 5. Checked for short to ground - | ____ | ____ |
| 6. Checked operation under power - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully completed according to manufacturer's specification and industry practice.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing General Heating Systems

**Duty No.** M

**Task No.** 3

**Task:** Clean and check a heating system, using appropriate tools, to insure proper operation.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Cleaned burners and combustion area - | | |
| 2. Cleaned heat exchangers and flue - | | |
| 3. Changed oil and/or air filters - | | |
| 4. Cleaned and checked burner and/or blower or circulation motors - | | |
| 5. Replaced oil nozzle (oil) - | | |
| 6. Cleaned and checked electrodes and insulators - | | |
| 7. Cheaned pilot and burner ofrices (gas) - | | |
| 8. Cleaned cadimum sulfide cell - | | |
| 9. Cleaned and checked flue dampers - | | |
| 10. Checked for worn belts - | | |
| 11. Cleaned blower blades (forced air) - | | |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

| | |
|---|---|
| **Duty:** Servicing General Heating Systems | **Duty No.** M<br>**Task No.** 4 |

**Task:** Check vent damper, using correct instrumentation, to insure proper operation.

**Achievement Indicators:** The learner: Yes No

1. Checked voltage - ____ ____
2. Checked for proper signal input voltage from thermostat -____ ____
3. Checked for correct sequence - ____ ____
4. Checked for proper shut-down - ____ ____
5. Checked for draft on bimetal dampers - ____ ____

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully completed according to manufacturer's specifications.

| **Tools and Equipment:** | **Resources:** |
|---|---|
| | |

**Duty:** Servicing General Heating Systems

**Duty No.** M

**Task No.** 5

**Task:** Vent sizing, using the proper charts and manufacturer's specifications, to insure correct vent capacity.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Determined input BTU for vent - | ____ | ____ |
| 2. Used manufacturers information in the determination - | ____ | ____ |
| 3. Checked for proper distance from chimney - | ____ | ____ |
| 4. Determined the number and type of fittings - | ____ | ____ |
| 5. Selected the correct venting material - | ____ | ____ |
| 6. Maintained proper distances from combustables - | ____ | ____ |
| 7. Selected proper draft regulating device (draft hood on barometric draft control) - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing General Heating Systems

**Duty No.** M

**Task No.** 6

**Task:** Install heating systems, using correct procedures, to insure a safe installation.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Made correct piping connections - | ____ | ____ |
| 2. Maintained correct clearances - | ____ | ____ |
| 3. Vented system, using proper materials - | ____ | ____ |
| 4. Made proper penetrations for venting and fuel piping - | ____ | ____ |
| 5. Maintained correct make-up air quantities - | ____ | ____ |
| 6. Installed proper safety shut-off at proper distances - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully completed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Servicing General Heating Systems

**Duty No.** M

**Task No.** 7

**Task:** Check auxillary or main heaters, using correct test instruments, to insure proper operation.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Measured continuity of heater - | ____ | ____ |
| 2. Checked for ground fault - | ____ | ____ |
| 3. Checked voltage at heater - | ____ | ____ |
| 4. Checked for heat output - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully completed according to manufacturer's specifications.

**Tools and Equipment:**

**Resources:**

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 1

**Task:** Perform a self-assessment, using knowledge and information, to compile a list of personal attributes.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Listed work-related accomplishments- | ____ | ____ |
| 2. Listed non-work related accomplishments - | ____ | ____ |
| 3. Identified skills and competency attainment - | ____ | ____ |
| 4. Identified transferable (portable) skills - | ____ | ____ |
| 5. Determined strengths and weaknesses - | ____ | ____ |
| 6. Described job liabilities and the affect liabilities have on employment opportunities - | ____ | ____ |
| 7. Developed a plan to overcome job liabilities - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**
Goodman, Jane, Judith Hoppin and Ronald Kent, "First Steps" in Opening Doors: A Practical Guide for Job Hunting. Continuum Center, Oakland University, 1984, pp. 7-14.

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 2

**Task:** Perform a self-assessment, using knowledge and information, to identify areas of work that will provide personal job satisfaction.

**Achievement Indicators:** The learner

| | Yes | No |
|---|---|---|
| 1. Listed personal job values - | ____ | ____ |
| 2. Rated each job value - | ____ | ____ |
| 3. Listed enjoyable activities/interests - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**
Ibid, pp. 16-20

|  |  |
|---|---|
| **Duty:** Using Employability Skills | **Duty No.** N<br>**Task No.** 3 |

**Task:** Perform a self-assessment, using knowledge and information, to determine methods to reduce levels of stress.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Identified stages of grief that result in stress - | ____ | ____ |
| 2. Identified factors that reduced levels of stress - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

| **Tools and Equipment:** | **Resources:** |
|---|---|
|  | Ibid, pp. 21-23. |

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 4

**Task:** Compile an occupational profile, using reference materials, to determine the characteristics, requirements, and employment outlook of an occupation.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Described: | | |
| a. Main job duties | ____ | ____ |
| b. Places of employment - | ____ | ____ |
| c. Physical demands - | ____ | ____ |
| d. Working (environmental) conditions - | ____ | ____ |
| e. Educational requirements - | ____ | ____ |
| f. Wage and fringe benefit information - | ____ | ____ |
| g. Local, regional and national employment outlook - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**

Dictionary of Occupational Titles (D.O.T.).

Goodman, Jane, Judith Hoppin and Ronald Kent, "Making Decisions," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 27-34.

Michigan Occupational Information System (M.O.I.S.)

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 5

**Task:** Investigate non-wage job characteristics, using available resources, to identify significant job factors.

**Achievement Indicators:** The learner

| | Yes | No |
|---|---|---|
| 1. Listed and described: | | |
| a. Union affiliation - | ____ | ____ |
| b. Apprenticeship opportunities - | ____ | ____ |
| c. Occupational hazards - | ____ | ____ |
| d. Shift requirements - | ____ | ____ |

**Criteria:**
Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**
Dictionary of Occupational Titles (D.O.T.).
Goodman, Jane, Judith Hoppin and Ronald Kent, "Making Decisions," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 27-34.
Michigan Occupational Information System (M.O.I.S.)

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 6

**Task:** Develop goals, using knowledge, to determine career objective(s).

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Listed short-term goals | ____ | ____ |
| 2. Listed long-term goals - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**
Ibid, pp. 30-31.

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 7

**Task:** Perform a job search, using information, to identify employment opportunities.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Determined geographic boundaries for job search - | ____ | ____ |
| 2. Listed types of potential places of employment - | ____ | ____ |
| 3. Developed a list of prime sources of information concerning opportunities for employment -- advertised and unadvertised - | ____ | ____ |
| 4. Gathered information about advertised and unadvertised job openings - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**

Goodman, Jane, Judith Hoppin and Ronald Kent, "Planning the Campaign," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 37-47

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 8

**Task:** Participate in an information interview, using knowledge and resources, to obtain information about a job from an employer.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Identified a job within the area of occupational interest - | ____ | ____ |
| 2. Prepared a list of organizations that employ people to perform the identified job - | ____ | ____ |
| 3. Scheduled an interview appointment with an employer at one of the organizations - | ____ | ____ |
| 4. Prepared a list of questions for the interview - | ____ | ____ |
| 5. Conducted the interview - | ____ | ____ |
| 6. Prepared a follow-up letter to mail, after the interview, to the employer | | |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**

Goodman, Jane, Judith Hoppin and Ronald Kent, "Planning the Job Campaign," *Opening Doors: A Practical Guide for Job Hunting*, Continuum Center, Oakland University, 1984, pp. 44-45.

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 9

**Task:** Complete a social security form, using information, to apply for a social security number.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Contacted appropriate office to secure form - | ____ | ____ |
| 2. Followed instructions on form - | ____ | ____ |
| 3. Filled in each space on the form with the correct information - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions

**Tools and Equipment:**

**Resources:**
"Handling the Paperwork," Employability Skills Guide #6, MSU.

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 10

**Task:** Contact an employer, using a telephone, to pursue potential employment opportunities.

**Achievement Indicators:**

| The learner: | Yes | NO |
|---|---|---|
| 1. Greeted receptionist - | ____ | ____ |
| 2. Identified self and reason for phone call - | ____ | ____ |
| 3. Asked to speak to appropriate person - | ____ | ____ |
| 4. Arranged, if necessary, a time to call back - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**

Goodman, Jane, Judith Hoppin, and Ronald Kent, "Communicating with Employers," in *Opening Doors: A Practical Guide for Job Hunting*, Continuum Center, Oakland University, 1984, pp. 54-57.

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 11

**Task:**
Complete a job application, using personal notes, to apply for employment.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Followed the directions specified on the application form - | ____ | ____ |
| 2. Filled in each space where applicable, with the correct information - | ____ | ____ |
| 3. Used a pen or typewriter to fill in application information - | ____ | ____ |
| 4. Filled out the application neatly - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**

Goodman, Jane, Judith Hoppin and Ronald Kent, "Communicating with Employers," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 61-64

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 12

**Task:** Prepare a resume, using personal information, to apply for a job.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Listed name, address, and telephone number - | ____ | ____ |
| 2. Identified career objective - | ____ | ____ |
| 3. Listed work experiences | ____ | ____ |
| 4. Described job-related experiences - | ____ | ____ |
| 5. Provided information about education - | ____ | ____ |
| 6. Listed military experience - if acquired - | ____ | ____ |
| 7. Described home/community activities - | ____ | ____ |
| 8. Listed membership in work-related organizations/ associations - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**

Goodman, Jane, Judith Hoppin and Ronald Kent, "Communicating with Employers," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 58-59, 65-71.

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 13

**Task:** Write a letter, using personal notes, to apply for a position.

**Achievement Indicators:** The learner: Yes No

1. Included:
    a. Name, address, phone number - ____ ____
    b. Date - ____ ____
    c. Name, title, firm, address of person to whom the letter is being sent - ____ ____
    d. Salutation - ____ ____
2. Indicated, in paragraph one:
    a. An awareness of the business - ____ ____
    b. A reference to an ability/skill that will benefit the company - ____ ____
3. Emphasized experience, abilities, accomplishments, in paragraph two - ____ ____
4. Identified strenghts/special training in paragraph three - ____ ____
5. Included a follow-up plan in paragraph four - ____ ____
6. Included complimentary closing - ____ ____
7. Signed letter - ____ ____

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 14

**Task:** Demonstrate appropriate dress, using a knowledge of job requirements, to comply with standards of on-the-job attire and grooming.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Described and/or dressed in the attire of the appropriate occupational area, including: | | |
| a. Grooming - | ____ | ____ |
| b. Health and safety equipment - | ____ | ____ |
| c. Uniforms - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**

Goodman, Jane, Judith Hoppin and Ronald Kent, "The Job Interview," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 77-96.

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 15

**Task:** Interview for a job, using communication skills, to secure employment.

**Achievement Indicators:** The learner: Yes No

1. Demonstrated appropriate characteristics for job applicants including:
   a. Attire - ____ ____
   b. Grooming - ____ ____
   c. Conduct - ____ ____
2. Demonstrated correct usage of interviewing techniques - ____ ____
3. Prepared a list of questions to ask the interviewer(s) - ____ ____
4. Prepared a follow-up letter to mail, after the interview, to the interviewer - ____ ____

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**

Goodman, Jane, Judith Hoppin and Ronald Kent, "The Job Interview," in Opening Doors: A Practicle Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 77-96.

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 16

**Task:** Contact a job interviewer, using a telephone, to accept/reject a job.

**Achievement Indicators:**

| The learner: | Yes | No |
|---|---|---|
| 1. Spoke with interviewer who offered the job - | | |
| 2. Identified self - | | |
| 3. Accepted offer, if applicable - | | |
| 4. Found out starting date and time, if appropriate - | | |
| 5. Rejected offer courteously and politely, if applicable - | | |
| 6. Gave reason for rejection, if applicable - | | |
| 7. Concluded conversation correctly - | | |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructor.

**Tools and Equipment:**

**Resources:**

"Getting the Job," Employability Skills Guide #9, MSU.

Ibid, pp. 77-96

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 17

**Task:** Complete forms, using information, to withhold city, state, and federal taxes.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Completed city tax form correctly - | ____ | ____ |
| 2. Completed state tax form correctly - | ____ | ____ |
| 3. Completed federal tax form correctly - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 18

**Task:** Describe performance evaluation measurements, using knowledge, to identify behavior/attitudes that employers expect employees to exhibit on-the-job.

**Achievement Indicators:** The learner:

| | Yes | No |
|---|---|---|
| 1. Listed and described the methods to achieve successful working relationships - | ____ | ____ |
| 2. Listed and defined importance of: | | |
| a. Reliability - | ____ | ____ |
| b. Punctuality - | ____ | ____ |
| c. Quality - | ____ | ____ |
| d. Quantity - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**

Goodman, Jane, Judith Hoppin and Ronald Kent, "Opening the Door to Your Future," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 99-100.

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 19

**Task:** Perform a continuing education program search, using available resources, to identify opportunities for retraining, skills upgrading, and career advancement.

**Achievement Indicators:** The learner: Yes No

1. Described types and sources of continuing education programs for an occupation - ____ ____
2. Related information to career alternatives - ____ ____

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**

Goodman, Jane, Judith Hoopin and Ronald Kent, "Opening the Door to Your Future," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, P. 101.

| | |
|---|---|
| **Duty:** Using Employability Skills | **Duty No.** N |
| | **Task No.** 20 |

**Task:** Analyze career information, using available resources, to identify the opportunities for advancement that exist within an occupation.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Described the career stages associated with the occupational area: | | |
| a. Listed jobs, entry through advanced levels - | ____ | ____ |
| b. Gave examples of tasks that employees in the occupation are required to perform - | ____ | ____ |
| c. Identified tools/equipment that employees in the occupation use - | ____ | ____ |
| d. Made reference to the relationship of the job(s) to data, people, things - | ____ | ____ |
| e. Made reference to education and/or on-the-job training needed to attain career mobility - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to instructions.

**Tools and Equipment:**

**Resources:**

D[illegible]ary of Occupational Titles (D.O.T.).
Goodman, Jane, Judith Hoppin and Ronald Kent, "Opening the Door to Your Future," in Opening Doors: A Practical Guide for Job Hunting, Continuum Center, Oakland University, 1984, pp. 99-102.
Michigan Occupational Information System (M.O.I.S.)

**Duty:** Using Employability Skills

**Duty No.** N

**Task No.** 21

**Task:** Describe job resignation/dismissal practice, using knowledge, to identify positive methods for terminating an employment situation.

| **Achievement Indicators:** The learner: | Yes | No |
|---|---|---|
| 1. Described practices for resigning from a job: | | |
| a. Gave two weeks to a months notice - | ____ | ____ |
| b. Specified a positive reason for leaving the employment situation - | ____ | ____ |
| 2. Described practices for job dismissal (laid off, released): | | |
| a. Asked the employer for a letter of reference, if laid off - | ____ | ____ |
| b. Talked with the employer to discover what was the problem, if released - | ____ | ____ |

**Criteria:** Competence in the task will be recognized when the achievement indicators are successfully performed according to the instructions.

**Tools and Equipment:**

**Resources:**
"Knowing the Score," Employability Skills, Guide #10, MSU.

# STUDENT ACHIEVEMENT RECORD

STUDENT ______________________________

**INSTRUCTIONS:**

Mark each student's level of competence according to the following guide:

| LEVEL | GUIDE |
|---|---|
| 1 | Student has been exposed to task |
| 2 | Task accomplished with assistance |
| 3 | Task accomplished to criteria by student |
| 4 | Ability to teach or demonstrate the task to others |

| TASK | LEVEL | DATE |
|---|---|---|
| A. PRACTICING SOLDERING, BENDING, SWAGING AND FLARING TECHNIQUES | | |
| 1. Cut copper tubing. | | |
| 2. Swage copper tubing. | | |
| 3. Flare copper tubing. | | |
| 4. Bend copper tubing. | | |
| 5. Solder copper tubing, using 50/30 solder. | | |
| 6. Solder copper tubing, using 95/5 solder. | | |
| 7. Silver solder copper tubing. | | |
| 8. Solder electrical connections. | | |
| | | |
| B. CUTTING, THREADING AND INSTALLING BLACK IRON PIPE | | |
| 1. Cut pipe to prepare it for threading. | | |
| 2. Thread pipe, using a hand operated threader. | | |
| 3. Thread pipe, using an electric pipe threader. | | |
| 4. Install gas piping. | | |

| TASK | LEVEL | DATE |
|---|---|---|
| C. SERVICING REFRIGERATION AND AIR CONDITIONING SYSTEMS | | |
| 1. Level a unit. | | |
| 2. Check door seal. | | |
| 3. Install a refrigerant system component. | | |
| 4. Install core-type service valves. | | |
| 5. Evacuate a refrigeration or air conditioning system. | | |
| 6. Test for leaks on a refrigerator or air conditioning system. | | |
| 7. Static charge a refrigeration or air conditioning system. | | |
| 8. Take temperature and pressure readings. | | |
| 9. Adjust a thermostatic expansion valve. | | |
| 10. Charge an operating system. | | |
| 11. Add oil to a system. | | |
| 12. Test a hermetic compressor motor. | | |
| 13. Adjust an automatic expansion valve. | | |
| 14. Trouble shoot a refrigeration system. | | |
| 15. Service a water regulating valve. | | |
| 16. Replace belts. | | |
| 17. Replace air filter. | | |
| 18. Perform annual maintenance on an air conditioning system. | | |
| 19. Check performance of an air conditioning system. | | |
| 20. Wire a refrigeration system. | | |
| 21. Install heat-cool thermostat and sub-base. | | |
| 22. Apply psychrometric charts. | | |
| 23. Install an air conditioning system. | | |
| 24. Treat cooling water. | | |
| 25. Service cooling water. | | |
| 26. Service heat exchangers. | | |
| 27. Service absorption systems. | | |
| 28. Service centrifugal system. | | |
| | | |
| | | |

| TASK | LEVEL | DATE |
|---|---|---|
| D. SERVICING PNEUMATIC SYSTEMS | | |
| 1. Check operating pressures. | | |
| 2. Service pneumatic controls. | | |
| 3. Service pneumatic controlled devices. | | |
| 4. Service air driers. | | |
| 5. Service air compressors. | | |
| | | |
| E. SERVICING ELECTRONIC SYSTEMS | | |
| 1. Service electronic control. | | |
| 2. Service energy management control systems. | | |
| 3. Service electronic timing devices. | | |
| 4. Service solid state control boards. | | |
| 5. Service electronic sensing devices. | | |
| | | |
| F. FABRICATING DUCT SYSTEMS | | |
| 1. Fabricate sheet metal fittings. | | |
| 2. Fabricate duct board fittings. | | |
| 3. Install ducting. | | |
| 4. Install diffusers. | | |
| 5. Measure air properties. | | |
| 6. Draft fittings. | | |
| | | |
| G. DESIGNING SYSTEMS | | |
| 1. Read blueprints. | | |
| 2. Calculate heat gain/loss. | | |
| 3. Calculate duct size. | | |
| 4. Calculate pipe size. | | |
| 5. Calculate product load. | | |
| 6. Select equipment. | | |
| 7. Prepare bid proposal. | | |
| 8. Calculate solar insolance. | | |
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| TASK | LEVEL | DATE |
|---|---|---|
| H. SERVICING ELECTRICAL COMPONENTS | | |
| 1. Demonstrate the use of test meters. | | |
| 2. Service capacitors. | | |
| 3. Service relays/contractors. | | |
| 4. Service motors. | | |
| 5. Service controls. | | |
| 6. Service heaters. | | |
| 7. Service transformers. | | |
| 8. Trouble shoot, to ascertain the source of problem. | | |
| | | |
| I. SERVICING GAS BURNERS | | |
| 1. Test gas valve operation. | | |
| 2. Check ignition circuit. | | |
| 3. Derate or change over a gas burner. | | |
| 4. Check and adjust gas gun. | | |
| 5. Check and adjust atmospheric injection burners. | | |
| | | |
| J. SERVICING OIL BURNERS | | |
| 1. Service primary controls. | | |
| 2. Check and adjust high/low pressure gun. | | |
| 3. Check and adjust vaporizing burners. | | |
| | | |
| K. SERVICING FORCED AIR SYSTEMS | | |
| 1. Service fan and limit control. | | |
| 2. Install a humidifier. | | |
| 3. Check blower components. | | |
| 4. Check operation of fan center. | | |
| | | |
| L. SERVICING HYDRONIC SYSTEMS | | |
| 1. Check circulator. | | |
| 2. Service hydronic aquastat control. | | |
| 3. Check operation of pressure/temperature gauge. | | |
| 4. Check and adjust the pressure reducing valve. | | |
| 5. Check operation of expansion tank. | | |

| TASK | LEVEL | DATE |
|---|---|---|
| L. SERVICING HYDRONIC SYSTEMS (continued) | | |
| 6. Check zone valve. | | |
| 7. Check safety controls. | | |
| | | |
| M. SERVICING GENERAL HEATING SYSTEMS | | |
| 1. Perform a combustion test. | | |
| 2. Wire a heating system. | | |
| 3. Clean and check a heating system. | | |
| 4. Check vent damper. | | |
| 5. Vent sizing. | | |
| 6. Install heating systems. | | |
| 7. Check auxillary or main heaters. | | |
| | | |
| N. USING EMPLOYABILITY SKILLS | | |
| 1. Perform a self-assessment to compile a list of personal attributes. | | |
| 2. Perform a self-assessment to identify areas of work that will provide personal job satisfaction. | | |
| 3. Perform a self-assessment to determine methods to reduce levels of stress. | | |
| 4. Compile an occupational profile. | | |
| 5. Investigate non-wage job characteristics. | | |
| 6. Develop goals. | | |
| 7. Perform a job search. | | |
| 8. Participate in an information interview. | | |
| 9. Complete a social security form. | | |
| 10. Contact an employer. | | |
| 11. Complete a job application. | | |
| 12. Prepare a resume. | | |
| 13. Write a letter. | | |
| 14. Demonstrate appropriate dress. | | |
| 15. Interview for a job. | | |
| 16. Contact a job interviewer. | | |
| 17. Complete forms. | | |

| TASK | LEVEL | DATE |
|---|---|---|
| N. USING EMPLOYABILITY SKILLS (continued) | | |
| 18. Describe performance evaluation measurements. | | |
| 19. Perform a continuing education program search. | | |
| 20. Analyze career information. | | |
| 21. Describe job resignation/dismissal practice. | | |
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## TOOL AND EQUIPMENT LIST

| Quantity | Equipment |
|---|---|
| 1 | Air Cleaner Electronic Trainer |
| 1 | Air Conditioner Split System |
| 3 | Air Conditioner - Window |
| 1 | Boiler Sydronic System or Trainer |
| 1 | Commercial Air Conditioner - Packaged System |
| 1 | Comdensate Pump |
| 1 | Condensing Unit 1/2 HP |
| 1 | Cooler - Reach In |
| 1 | Dehumidifier - McGraw |
| 2 | Domestic Refrigerator |
| 1 | Drinking Water Cooler |
| 3 | Forced-Air Gas Furnace |
| 3 | Furnace Oil-Fired |
| 1 | Gas Furnace - Recuperative Type |
| 1 | Heat Pump System |
| 1 | Heat Pump System Trainer |
| 2 | Humidifier Power Wheel Type |
| 1 | Hupp Condensing Unit - 1/8 HP |
| 1 | Ice Maker - Cuber |
| 1 | Trainer Gas Heating |
| 1 | Trainer Refrigeration |
| 1 | Training Unit Oil Burner |

| Quantity | Tools |
|---|---|
| 4 | Acetylene B-Tank |
| 4 | Acetylene Regulator Hose & Tips |
| 6 | Amprobe RS 3A |
| 1 | Analyzer "Annie" Hermetic |
| 1 | Bar Foler |
| 6 | Basic Electrical Trainer |
| 3 | Bench Vice Metal/Wood Top |
| 2 | C Clamps |
| 1 | Capacitor Analyzer Robinair |
| 4 | Charge Check Cylinder |
| 1 | Conduit Pipe Bender - Thin Wall |
| 1 | Cooling Tower Trainer |
| 1 | Divider Set |
| 2 | Drills 3/8" Elect. Rockwell |
| 1 | Electric Pipe Threading Machine |
| 1 | Electronic Temperature Recorder |
| 6 | Folding Ruler - 6 ft. |
| 1 | Gear Puller Set |
| 1 | Grinder Bench 110V |
| 2 | Hand Formers |
| 1 | Humidity Indicator |
| 1 | Kit Fyrite Test |
| 1 | Kit Quick Start 220V |
| 2 | Kit Start Quick 110V |
| 1 | Lockformer 20 Gauge Capacity |
| 2 | Mallet - Wooden |

| Quantity | Tools (continued) |
|---|---|
| 2 | Mercury Manometer |
| 1 | Micrometer 0" - 1" |
| 1 | Micrometer 1" - 2" |
| 1 | Millivolt Meter |
| 1 | Moisture Temp. Meter |
| 2 | Oil Pump Cap Check |
| 1 | Pan Brake 3 ft. width 16 Gauge |
| 1 | Pip Rivet Gun |
| 2 | Pump Vacuum 2 Stage |
| 4 | Reamers |
| 1 | Sampler Gas |
| 2 | Service Valve Kit |
| 1 | Shear |
| 1 | Sling Psychrometer |
| 6 | Snips Tin - Right/Left/Straight/Pipe/12" Compound |
| 1 | Soldering Gun |
| 3 | Squares - Combination |
| 2 | Syst-Check Deluxe-Thermal |
| 1 | Tap and Die Set |
| 6 | Tape Measure - 10 ft. |
| 5 | Temp. Check Deluxe - Thermal Co. |
| 1 | Tester Smoke Kit - Bacharch |
| 1 | Threading Dies |
| 2 | Three foot Metal Rule |
| 1 | Truck-Universal Appliance |
| 1 | Vac Check |
| 1 | Vacuum Cleaner |
| 1 | Vane-Type Velometer |
| 2 | Wattmeter Volt |
| 1 | Welder Spot Portable |
| 1 | Welding Unit Oxy-Acetylene |
| 1 | Wheel Puller Set |
| 4 | Wrench Pipe Set |
| 1 | Wrench - Torque |

| Quantity | Basic Tools |
|---|---|
| 2 | Chisels Set |
| 3 | Combination Wrench Set |
| 12 | Diagonal Cutters |
| 2 | File Set |
| 6 | Flare/Swage Set |
| 2 | Flashlight Industrial |
| 3 | Fuse Pullers |
| 10 | Gauges - Manifold |
| 2 | Hack Saw |
| 6 | Hammer Ballpeen |
| 6 | Hand Tool Set - Refrigeration |
| 3 | Nut Driver Set |
| 1 | Pinch Off Tool |

| Quantity | Basic Tools (continued) |
|---|---|
| 12 | Pliers |
| 6 | Pocket Thermometers |
| 4 | Rivet Set |
| 4 | Scratch-All |
| 4 | Screwdriver Set |
| 2 | Sockets & Ratchet Set - 1/2" & 3/8" Drive, 1/4" Drive |
| 2 | Torch Tip - Propane |
| 2 | Tubing Bender Set |
| 6 | Tubing Cutter Kit |
| 2 | Tubing/Wrench Set |
| 6 | Vommeter |
| 4 | Wire Strippers |
| 1 | Wrenches - Allen |

| Quantity | Lab Related |
|---|---|
| 4 | Shevles Storage |
| 1 | Shop Desk |

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